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East Europe Report

SCIENTIFIC AFFAIRS

No. 768

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CONTENTS

ROLE OF SCIENCE IN SOCIETY DISCUSSED

Prague ZEMEDELSKE NOVINY in Czech 31 Dec 82 p 4

[Interview with Academician Anton Blazej, rector of the Slovak Technical College, delegate to the Federal Assembly and member of the Federal Assembly Presidium, conducted by Karel Klouda; "Facing the 21st Century"; date and place not given]

[Excerpts] [Question] What, in your opinion, will exert the most significant influence on the pace of social development, and thereby on our entire lifestyle?

[Answer] An unambiguous answer suggests itself: science. But to put it more precisely, it will be our ability to make use of research and development results and to incorporate them systematically into all fields.

[Question] This, however, requires people capable not only of assimilating scientific findings, but of implementing them as well. Are we, as people, prepared for this encroachment of science into our daily lives?

[Answer] Certainly, at least in terms of the general level of education. Bear in mind that right now we are among the foremost countries in this regard, and that our professional schools have a good reputation throughout the world as well. In terms of colleges, they have so far graduated about every 16th citizen, and by the year 2000 every 10th citizen will have a college diploma. This means that we will have an adequate number of potential users of science. The question, however, is how they will be able to adapt to the conditions which will accompany this scientific and technical development. In this area, I think that if a person desires to becomes a well-adjusted citizen he will to an increasing extent have to master both new scientific findings and the ability to make rational use of them. This will be true at both the social and the personal level.

[Question] In general terms, everyone certainly has to agree with you. However, the application of science can also cause real problems for people, for instance with their job. The application of electronics or the introduction of robots lead to significant labor savings...

[Answer] This is a problem that we must deal with. It will be quite common for an individual, in the course of his productive life, to change his area of specialization two or three times. Certain preconditions for this are already being set up by the school system, in the sense that fields of study are being conceptualized in a broader context, thereby fostering greater adaptability by graduates to specific specialties. At the same time, I would like to emphasize that, in contrast to capitalism, our objective is to liberate workers from direct material production. More and more people are necessary for technical preparation for production and in the area of services, so fears of unemployment are not appropriate. Besides, if we succeed in forming sufficient financial and material resources, we will be able to proceed to a further shortening of working time.

[Question] Only scientific and technical development which corresponds to human development can be successful. You are the rector of the largest technical school in Czechoslovakia--what is your view on this?

[Answer] I agree that human upbringing and the development of technology must be in accord with each other. Therefore, as far as colleges are concerned, I see a future for the technical university, that is, for the humanization of technical education and the technicalization of humanistic education. I have, therefore, set for our school the task of setting up a department of engineering-humanistic sciences, at which we wish to assure the teaching of a humanistic disciplines as part of the engineering curriculum. It is my view that 5 to 10 percent of this curriculum should consist of humanistic fields such as psychology, sociology, pedagogy as well as fine arts. In the future, not only technical competence, but also social awareness will be critical to the professional training of an engineer. Future engineers will have to deal with the resolution of certain social questions, namely the training and management of people, the influencing of interpersonal relationships, and the activation of the creative abilities of individuals and collectives. Today's engineers have not, for the most part, been prepared in these areas.

[Question] Even those from your school?

[Answer] Not even those from our school, although I think that we are farthest advanced on this matter. We have even prepared a proposal for an international conference on new trends, techniques and forms of engineering education for the World Federation of Engineering Organizations, which should take place in 1984 at our school. This conference will provide an overview of engineering studies from the viewpoint of the needs of the 21st century. One section of the conference will be dedicated specifically to the humanization of technical education.

[Question] This implies that a certain danger of overestimating technology objectively exists...

[Answer] Yes, and precisely for this reason we must do everything in our power to assure that technology serves human interests. It is also important for this reason to integrate university and technical education and to assure generally the harmonious development of the individual. This means an educated, cultured person, with a broad range of interests.

[Question] The cultural level of a person may not be separated from his material well-being. And in this regard arises the question of whether the further enrichment of life with material goods is possible under our conditions without worsening the environment?

[Answer] I do not think that these two problems need be at odds with each other, but that both may be resolved simultaneously and positively. There already exist technological possibilities, in other words technology which may be called ecological. For instance, there are wasteless technologies, those which prevent a worsening of the environment. Of course, this will require a change in attitude toward the environment. Capital construction must take into account ecological facilities which are a part of projects and not an afterthrought. By the same token, the operating costs of these ecological installations must become a part of production costs, as costs for the reproduction of a healthy environment. However, such thinking is not yet prevalent among our managerial employees...

[Question] This is why homes or factories are built, but not waste water treatment facilities...

[Answer] The latter will be crossed out, because insofar as investment costs must be reduced, those projects are crossed off which appear to hurt the least. In reality, however, these hurt the most because people bear the brunt of their absence. And because it is precisely the individual who is in the forefront of our interest, we must respect first of all the health and development of the individual and the entire population.

[Question] Except that certain situations appear insoluble. Agriculture, for instance, has the top-priority task of providing for the ever better feeding of the population. It cannot achieve this, however, without ever increasing amounts of fertilizer, which in turn exerts a negative effect on the environment. Do you see any sort of solution?

[Answer] Our agricultural production does actually constitute one of the greatest environmental polluters. There are basically three reasons for this. We use large quantities of industrial fertilizers which are applied in a form providing a low level of usability, meaning that large losses take place through percolation into ground water and water flows. The second reason stems from the concentration of livestock production and the resultant generation of large quantities of livestock excrement, which is not utilized for the most part as a potential source of organic fertilizer, but is released into sewage systems. Finally, in agriculture the waste products, i.e., the secondary raw materials, are very inefficiently processed.

[Question] Is it within the power of farmers to solve these problems?

[Answer] If it is, a helping hand must be extended to them by both science and industry. Nevertheless, I think that for the future it is impossible to rely on the production of basic foodstuffs by strictly traditional methods. We have a relatively low allotment of arable land--about 0.32 hectares per capita--and a further reduction of this figure is inevitable. Moreover, the chemicalization of agricultural production reached an optimal level in the 1974-1976 period, and since this time a certain decline has been recorded in the bioenergetic and ecological potential of the soil. On the one hand, a salinization of the soil is occurring, and on the other hand, the percentage of organic humus is declining. Our soils today contain only about 40 percent of the theoretically necessary amounts of organic materials. And moreover, the traditional means of raising foodstuffs is exceptionally energy intensive. For the production of 1 joule of energy value from meat, we require 10 joules of fossil fuels, a ratio that is unacceptable for the future. I am speaking of the nineties and the year 2000.

[Question] That is not in the too far distant future. How do you envision the assurance of self-sufficiency in food production in 10 to 20 years?

[Answer] I see two possibilities. The first is the microbiological production of proteins, for which energy consumption is one-half that of traditional production methods. Otherwise I see the modification of plant protein production through genetic manipulation in such a way as to change their composition in terms of nutritional value (their amino acid composition) to resemble that of meat. Energy consumption for these techniques is lower still.

Nor should we overlook the possibility of cultivating fast-growing wood species which can at times yield a greater impact than grains. Cellulose may be modified so that it can replace concentrated fodder. It is also possible to produce microbiological protein from poplar and other wood. And finally, in cases of necessity we can interchange agricultural and forest land, thereby improving the bioenergy potential of the soil.

[Question] We have been discussing science and its role in society, and the prospects which it holds for us in the future. What can tomorrow, next week, in short the new year contribute to realizing the possibilities that we have mentioned?

[Answer] I think that tomorrow and in the new year we must be busy preparing for the year 2000. That is, for a time when it is expected that a person will devote one-third of his time to education, one-third to work, and one-third to rest and his personal interests. Life will be materially richer and psychically more demanding. In terms of the rate of change, it will be necessary to cope with and adapt to new and continually changing conditions. The life style of the individual and the society must be shaped in accordance with these trends. And so today, tomorrow, in the upcoming year we can, and indeed we must, prepare ourselves so that these expected changes do not pass us by.

9276
CSO: 2402/23

ACADEMY STAND ON LONG TERM DEVELOPMENT OF ELECTRONICS

Budapest MAGYAR TUDOMANY in Hungarian No 11, 82 pp 866-869

[Article by A. Cs.: "Stand Taken by the Technical Sciences Department of the MTA Concerning the Long-Term Development of Electronics"]

[Excerpts] In the summer of 1981 the Technical Sciences Department of the MTA [Hungarian Academy of Sciences] called upon a committee to develop a stand which could be taken by that body concerning the long-term development of Hungarian electronics. The chairman of the committee was P. Otto Geszti, regular member of the MTA and a department chairman, and the members were Tibor Vamos, regular member of the MTA, Sandor Csibi, Jozsef Lukacs, Elemer Nagy and Karoly Szendy, corresponding members of the MTA, Janos Sebestyen, Gyorgy Darvas and Adam Juhasz, members of the department with consulting rights, and Istvan Littvai, deputy minister, and Mihaly Sandory, government commissioner. Andras Ambrozy, Ivan Berend, Jozsef Budinszky, Emil Kren, Gyorgy Marosan, Jr., Laszlo Pal and Ivan Szep and the secretary of the committee, Arpad Csurgay, contributed to the work with their analytical studies.

The government dealt with the long-term development of the Hungarian electronics industry in December 1981 and passed a resolution on the starting of a central development program to ensure the supply of electronic parts. The Ministry of Industry established a new enterprise for the manufacture of microelectronic parts.

In the course of the preparation of the resolution, lasting years, it became obvious that the decision-making situation was extraordinarily complex. It is understandable that the debates became sharp; the proposals--despite the best intentions--were frequently extreme and contradicted one another. Everyone agreed that the use of electronics in every area of the economy and infrastructure was a condition for our development, but even today no consensus has been achieved in judging domestic needs or in regard to the developmental strategy of the domestic electronics industry. It is understandable that both those in guidance and the divided professional public opinion looked--and continue to look--with great expectation toward the positions taken by the Hungarian Academy of Sciences. Naturally, they do not expect from the Academy a concrete evaluation of Hungarian industry or the working out of a program for it, for this is the task of the Ministry of Industry and the OMFB [National Technical Development Committee]. With its analysis of critical decisions

influencing the future and of desirable and possible development strategies, the MTA can contribute to finding and successfully following the developmental path best suiting the conditions of our homeland. One must outline the future, but not that which we can foresee at a given moment; rather, one must outline that future which moves forward with the experience we develop in time.

The position published in November 1981--about which we will speak in this brief report--was prepared in this spirit and with this responsibility.

The November 1981 position of the Technical Sciences Department convincingly proves that the spreading use of electronics is a precondition for the development of both production and infrastructure. The unfolding world competition in the area of electronicization is a sharp challenge even for countries more developed and richer than our homeland. We cannot preserve our achievements if we turn aside from this challenge, but our developmental strategy must be tailored to our conditions and possibilities.

What Can We Do? What Are We Doing?

Electronicization is a technical world process in which our homeland must participate, because it affects every area of life, material and energy management, the foodstuffs economy, industrial production, communications, transportation, health, trade, finance, education and scientific research alike.

There are three sides to the development of electronics: 1. Service to the developmental goals of the Hungarian economy and society through the electronicization of the human environment (information technology and automation); 2. Building electronics into products to improve the competitiveness of the products of Hungarian industry; and, 3. Development of a Hungarian electronics industry to manufacture electronic products as a form of undertaking.

The three sides do not necessarily require the same developmental strategy, but coordinating them is desirable because this promises advantages.

The Hungarian Electronics Industry

There are traditions for an electronics industry in Hungary. Our traditions in signal technology, the instruments industry and the electric motor and apparatus industry (Tungsram, Orion, BHG [Beloiannisz Telecommunication Factory], Ganz, etc.) provided a good framework; up to the 1960's our electronics industry was in the middle range of the world and its undertakings were successful. In the past 20 years the share of electronics in our industrial production rose from 4.8 to 8 percent; growth in the volume of production exceeded 11 percent per year; and in 1980 about 110,000 workers produced electronic products worth nearly 45 billion forints.

It can be established that the activity of the electronics industry fits well the conditions of our country, because the volume of the material fraction used is low and the ratio of human work--especially highly qualified work--is high.

Despite the valuable traditions and favorable conditions the intensive quantitative development of the 1960's and 1970's was accompanied by obsolescence and an increasingly rigid product structure. The intellectual work content of our products is low. One reason for this was the backwardness in use of highly integrated circuits. In 1980 the number of active elements per unit value of product in the products of Hungarian industry did not reach, as an average, one-tenth of the world average. At the same time nearly two-thirds of the parts of our products, which could hardly be sold on the markets of the developed capitalist countries, were acquired from the most developed capitalist countries.

The problems urge a change in the developmental strategy of the Hungarian electronics industry. Instead of quantitative growth and trying to force export, we should strive to see that our electronics industry works on both the ruble and dollar accounting markets with a positive balance and significant profit, while satisfying domestic needs in certain designated areas. In the meantime we must reckon with a significant increase in the import of electronic products, which should be used to expand export by the Hungarian electronics industry--via cooperation links and common undertakings.

The change in developmental strategy will require strengthening the qualitative side of development, even if this takes place at the expense of the volume of production.

Starting the Central Development Program to responsibly organize the supply of electronic parts removes one obstacle for which a state decision was needed. It must be seen, however, that the domestic parts manufacture to be started in the wake of this decision will cover only a part of the needs, that the competitiveness of our electronic industry products will continue to depend on the import of modern parts and that our equipment manufacturing enterprises must achieve results in sharp competition. We must accelerate the absorption of new research results, improve the level of product development and speed up the introduction of new technologies--including the technology of software development.

Electronicization

Per capita "consumption" of electronic products in our homeland lags substantially behind the European average and does not even reach the world average despite the significant volume of our production or export. If we post the modest goal of having the per capita value of electronicization follow the world average between 1981 and 1990--which was 90 dollars per capita in 1980--then we must provide a supply worth about 14 billion dollars at current prices in the 10 years (1981 to 1990). Western Europe could be followed with a 10 year consumption worth more than 40 billion. The level of electronicization in our homeland lags substantially behind our average level of development. In the 10 years before us we must realistically reckon that the demand of production and of the infrastructure for electronic products will increase significantly and that domestic industry will be able to satisfy a decreasing proportion of the demand. There is a burning need to regularly and continuously survey the medium and long-term needs of electronicization and to coordinate the

needs with the developmental programs of the Hungarian electronics industry--especially of the branches manufacturing equipment.

To sum up, in the years ahead of us special attention should be devoted to: 1. Electronicization of production and infrastructure corresponding to our conditions; 2. Improving the competitiveness of industrial products by building in electronic subassemblies; 3. Improving the competitiveness of the Hungarian electronics industry; 4. Ensuring a supply of microelectronic and other parts; 5. Developing the middle and higher level and post-graduate training of experts; and, last but not least, 6. The activity of scientific schools working in the area of electronics which understand the laws of movement of the special areas.

8984
CSO: 2502/16

DEVELOPMENT PROGRAM FOR COMPUTER ENGINEERING

Budapest MAGYAR TUDOMANY in Hungarian No 11, 82 pp 869-872

[Article by Laszlo Pal: "The Computer Technology Central Development Program and Its Research Target Programs"]

[Text] In 1981 the government approved the third 5-year phase of the computer technology central development program. The work of the central development program began in 1969, based on the goals and division of labor set forth by the Computer Technology Inter-Government Committee created at this time at the initiative of the government of the Soviet Union and on the computer technology development conception adopted by the Economic Committee. During the Fourth 5-Year Plan (1971-1975) the chief goal of the central development program was to lay the foundations for domestic computer technology culture and to organize a Hungarian computer technology industry, in harmony with the principles which had been developed for the international cooperation of the socialist countries.

The bases for computer technology culture had been created by 1975. An inventory of computers had been built up which proved, in various branches and in various spheres of social-economic activity, the usefulness and economic efficiency of using computer technology, created a possibility for experts to acquire suitable experience and produced direct results for the larger part of the applications.

As a fundamental achievement of the program the training of experts using computer technology began in virtually every college and university in the country. In addition, forms for training computer technology specialists were established in our middle and higher level educational institutions and the training of computer technology instructors and further training of specialists was realized based on foreign experiences and know-how (SZAMOK [Computer Technology Training Center]).

On the basis of technical development strategies and specialization agreements developed by the Computer Technology Inter-Government Committee and by adapting capitalist licenses the bases for a domestic computer technology industry were created and a swift development of this industry began on the basis of commercial agreements signed with socialist partners. Its product structure

was made up of small computers and associated peripherals and of simpler tools for remote data processing.

An institutional system for computer technology research, development, training, manufacture, trade, applications and services was established and stabilized in the period 1971-1975. A number of research and organizational institutes entered computer technology research and development work and new institutes were formed. An organization for planning and for state guidance of the computer technology program was created and a system for cooperation and dividion of labor among ministries was formed.

Between 1971 and 1975 the ratio of machines belonging to the uniform computer system (ESZR) constantly increased in our computer technology imports and by the end of the plan period the share of these machines had become the determining factor in our inventory of computers.

In accordance with the foundations which had come into being the goals of the central development program were modified for the Fifth 5-Year Plan (1976-1980). The chief tasks were as follows:

--Better use of the existing machine inventory, better serving our economic goals;

--Bringing new applications areas into the computer technology program;

--Solving more complex applications tasks;

--A swift increase in the socialist export of the computer technology industry;

--Complete modernization of the domestic computer technology product structure;

--Starting non-ruble accounting export by the computer technology industry; and

--Laying the foundations for a software industry.

As a result of the 5 years activity the domestic computer inventory increased further, including an increase in the ratio of machines of socialist and domestic origin. The use index of the computers reached an average of two shifts, acceptable even at the international level, and the use of the larger machines therein was substantially higher. In addition to using one's own computers, there was a swift increase in the number of institutions making regular use of computer services. By the end of the Fifth 5-Year Plan period more than 2,000 domestic enterprises and institutions used the services offered by computer technology to monitor or control technical-economic processes.

In 1980 the volume of the production of the computer technology industry approached 5 billion forints per year. Marketing in the socialist relationship accounted for about 70 percent of the production value and domestic sales accounted for 25 percent. Export in the non-ruble accounting relationship

came to more than 10 million dollars, primarily within the framework of cooperation deals.

Foreign sales of software products began also. A swiftly growing marketing possibility opened up with a number of leading Western European computer technology institutions. The domestic spread of nicrocomputers began, somewhat late but at a very great pace. The number of them by the end of the plan period exceeded 2,000. In the course of the plan period the penetration of computer technology into the products and technologies of other branches accelerated. More and more signal technology and instrument industry enterprises took over third generation technologies, built microprocessors into their products and included small computers produced by domestic industry in their complete equipment and complex systems.

The central development program approved for the Sixth 5-Year Plan (1981-1985) has turned primarily toward applications. The chief goal--in harmony with our economic conditions--is an intensification of applications, increasing the complexity of systems directly influencing the economicalness of production, carrying out computerization tasks interdependent with a modernization of state administration and the development of providing information, computer support for technological, warehousing, stockpiling, transportation and other processes of industry and agriculture, increasing computerized automation improving materials and energy conservation and increasing the effectiveness of engineering design and scientific work with the aid of computer technology. The chief task of our computer technology industry is to compensate for productive import from the capitalist relationship--in addition to stabilizing the positions achieved on socialist markets. The development of a computer technology services network, ensuring conditions for industrial software manufacture, increasing trade in software, laying the foundations for a computer network, and development of service and parts supply received a stressed role in the program.

This phase of the program is open. The conditions system for its realization was developed in harmony with the economic policy goals of the Sixth 5-Year Plan. Discovering the reserves hiding in the technologies of computer information processing and spreading modern procedures and methods received an increasing role. Expanding the capacity of the computer inventory is limited in this period because of limits on the investment assets available. In this regard a significant task will be to replace systems which have become obsolete.

In the course of planning it was possible to define a sphere of enterprises which are developing their activities with significant dynamics, which want to rely on computer technology in achieving their medium-range goals, and are treating computerization as an important condition for realizing their achievements. Enterprise applications must serve directly to increase economic efficiency, must increase the quality of products and services. In regard to the elements of enterprise management information systems, it would be useful to computerize economic and technical planning, production guidance and cost, stockpile, fixed assets and manpower management, keeping in mind harmony

between organization, computer technology applications and automation, improving receptivity and ensuring the personnel conditions.

The spread of automatic computerized technological process control must be increased compared to what has been achieved. An effort must be made to see that the creation of new technologies and the reconstruction of old ones is accompanied by the introduction of computerized process control in every area where it is economical. From the viewpoint of investment the automatic guidance systems must be treated together with the carrying technologies.

The program establishes that the spread of computer assisted engineering design is an indispensable condition for the swifter creation of modern products and manufacturing technologies, for freeing creative intellectual technologies of routine tasks and for developing the ability of enterprises to make bids.

The development of computer technology services organizations has two chief goals. On the one hand ensuring the conditions for the development and operation of applications depends in large measure on the quality of the activity of these organizations. On the other hand it is the mission of these organizations to bring into the ranks of organizations regularly using computer technology more and more institutions which do not have their own expert and tools base.

New enterprises, in addition to the earlier ones, will be brought into the development of the computer technology service network.

The following are the most significant of the computerization tasks of state administration:

--Developing cooperation among central state administrative data processing systems;

--Creating computer technology bases for regional administration;

--Rational development and integration of national basic records; and

--Developing information systems for economic ministries.

The KSH [Central Statistics Office], the PM [Ministry of Finance], the OT [National Planning Office] and the AMBH [expansion unknown] have as a goal the creation of a coordinated state administrative data base network.

The central development program also presumes that during the Sixth 5-Year Plan the technical base for new computer technology capacity will consist primarily of domestic products and of socialist import devices belonging to the ESZR or MSZR [minicomputer system]. Acquisition of devices belonging to the second developmental stage of the ESZR and, after 1984, to the third state of the ESZR seems to ensure the supply of computers of medium and medium large capacity. In addition to a substantial improvement in the price/performance indexes for these machines one can also expect a large scale development in peripherals supply.

The larger part of the need for small and minicomputers and data collection and recording systems can be satisfied from domestic manufacture, and a smaller proportion from socialist imports. Domestic computer producers plan to deliver to domestic users primarily complete small and minicomputer systems in the areas of enterprise guidance subsystems, regional information systems and energetics and transportation process control.

In accordance with world trends, in our homeland also ever greater emphasis will be given to software needs and expenditures in the creation of computer technology systems. Measures are being taken to make complete, and to a realistic degree uniform, the supply of basic software, to put this into operation and develop a follow-up system, and to ensure error elimination and continual further development. Serious organizational work is taking place within the framework of the program in the interest of standardizing software manufacture technologies and widely disseminating them and in the interest of resolving legal and commercial problems hindering trade. In regard to program products, the development of general use program packages is taking place on the basis of a coordinated plan and the development of a regulatory system supporting repeated sale of programs is on the agenda. Standardizing program documentation could also contribute to reducing superfluously parallel developments.

A program titled "Research and Development for Computer Technology Applications System" was approved in 1980 within the framework of the OKKFT [National Medium Range Research and Development Plan]. Within this program they are developing model systems aimed at achieving concrete economic results in the area of material production (for example, systems for integrated production guidance in large enterprises, integrated electronic design, manufacturing and control systems, model applications system for agriculture and the food industry and model systems for enterprise applications using ESZR and MSZR computers of domestic manufacture). The OKKFT program also contains R and D projects aimed at creating model systems for council administration and the research necessary to disseminate program development methods and model software making possible the use of modern technology.

The joint programs of the Ministry of Industry and the OMFB aimed at research and development for small computers and systems and their peripherals is a task of great importance for the period of the Sixth 5-Year Plan. It prescribes the development of the most important hardware and basic software. The results of this will begin to appear in 1983 in the offerings of our industrial enterprises. The most important themes are: domestic small computers belonging to the developmental phase following the ESZR and MSZR systems, increased capacity memories, alphanumeric and graphic display families with a high degree of intelligence, cheaper or faster printers and research and development on tools and systems for remote data processing.

Institutions of the OMFB, Ministry of Industry and the MTA are working jointly on a ministerial program titled "Research and Development for Microcomputers and Their Applications Systems." This program has as its goal the development and manufacture of a microcomputer family of appropriate variety (8 and 16 bit), a supply of basic and applications software, developmental systems and microperipherals.

The OMFB--based on work done jointly with the KSH and appropriate departments of the MTA--has developed a conception titled "Computerization in the Long-Range Development of Our Homeland," which was adopted by a plenum of the OMFB and submitted to the government. The conception starts from the idea that the expansion of the social division of labor and the increasing socialization of research, technical development, production and commercial processes requires the broadest possible utilization of the productive forces hiding in useful information acquired in the course of human activity. A well organized flow of information becomes one of the basic pillars of the efficient functioning of society and elements of innovation processes become, to an ever-increasing extent, information-centered.

To an increasing extent the realization of the basic aspirations defined by economic policy (efficiency, productivity, quality, organization, decision mechanisms, competitiveness, conservation) will depend on an exploitation of the possibilities offered by information technologies. For this very reason the conception recommends the spread of a type of economic policy thinking in which electronicization based on computer technology, telecommunications and automation becomes a stressed developmental aspiration and in which, in practice, the solution possibilities offered by information technologies are always considered among the solution alternatives for social-economic tasks.

Laying the foundations for long-range scientific research programs has begun taking this aspiration into consideration in the areas of:

--material production branches (continuous technologies, resources research, phased production processes, agricultural and animal husbandry processes, stockpile management and technical design systems),

--development of the infrastructure (distribution of resources, optimization of transportation processes, coordination of shipping processes and mechanization of public services), and

--non-material branches (electronicization of banking processes, mass communication news systems, electronic mail, computer assisted instruction, office automation, support for health services, etc.).

8984
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MEDIUM TERM R&D PROGRAM FOR MICROELECTRONICS

Budapest MAGYAR TUDOMANY in Hungarian No 11, 82 pp 872-875

[Article by Emil Kren: "Medium Term Research and Development Program for Microelectronics"]

[Text] Development of the Program

A new stage in the planning, guidance and financing of research and development activity began with the initiation of the Sixth 5-Year Plan when a National Medium-Range Research and Development Plan (OKKFT) was prepared for the first time. This was approved by the Council of Ministers in December 1980. The OKKFT defines science policy principles, goals and tasks for the period of the Sixth 5-Year Plan, formulates 15 most significant programs oriented toward immediate economic goals and deals with the resources available for research and development purposes and with guidance of execution of the programs. The programs of the OKKFT reflect the developmental priorities of the medium-range economic plan, in general require the cooperation of a number of scientific and user branches and are of an inter-ministry character in regard to both costs and guidance.

Development of the OKKFT took place in 1979-1980, years which fell in a period which gave birth to ideas pertaining to the development of the electronic parts industry. At this time the economic importance of the development of the electronics industry became clear to many and it became clear that the key to this--if not the only key still the most essential one--was development of the parts industry and of microelectronics therein. So it is understandable that there were proposals to include in the OKKFT programs connected with the electronic parts industry. The Hungarian Academy of Sciences formulated proposals for the research background for electronic primary materials and parts manufacture and the Ministry of Metallurgy and the Machine Industry formulated proposals for research and development for microelectronic parts. By combining these an inter-organizational work group worked out a single, common plan. The program titled "Research and Development for Microelectronic Parts, Technologies and Primary Materials" became part of the OKKFT with the designation A/4 and the first secretary of the MTA [Hungarian Academy of Sciences] and the industrial minister became jointly responsible for its execution.

Execution of the microelectronics research and development program could not begin with full force after the approval of the OKKFT in December 1980 because, unfortunately, the gestation of the developmental concept for the electronic parts industry carried over into 1981. This conception had been developed by the end of 1981 and on the basis of it the Council of Ministers could pass a resolution concerning the initiation of the central development program for electronic parts and subassemblies (EKFP). In September 1981 the OKKFT microelectronics program had to be reworked to bring it into harmony with the EKFP and it was approved, together with the EKFP, in its reworked form. After working out and adopting a detailed work plan for 1982 the program got started within organized frameworks in January 1982.

The Goal and Content of the Program

The chief general goal of the program is support, from the research and development side, for the creation and development of a microelectronic parts industry in the interest of moderating the capitalist import of electronic parts and improving the competitiveness of the electronics industry. In order to decrease the significant backwardness existing in the area of microelectronic technologies the program posts as a goal the introduction of modern--but not the most modern--technologies through the purchase of licenses or with our own developments. It wants to make the domestic research and development base suitable for reception of the manufacturing know-how and technological equipment to be purchases and for acquiring through its own research and development the information which cannot be purchases, pertaining primarily to devices of a high degree of complexity (LSI).

A further general goal of the program is to aid participation in the international cooperation of the socialist countries, developing technologies and devices which can be used as an exchange base.

It is worth taking a look at the substantive sphere of our microelectronics program. According to the dictionary definition microelectronics is that branch of electronics which deals with the design, production and use of electronic devices of very small size with very high element density. At present the domestic program concentrates on design and production tasks, but beginning in 1983--by bringing in a broad sphere of users--it will be expanded with applications techniques tasks also. The development of automatic measuring devices suitable for testing various types of integrated circuits is part of the program, but it does not deal with the development of the other technological equipment needed to produce integrated circuits. Similarly, the program does not contain activity connected with the primary and auxiliary materials indispensable for manufacture--disregarding some partial tasks of minor significance. Lacking the necessary research and development base and agreements with the socialist countries these tasks remained out of the program. After the hoped for development of cooperation among socialist countries the expansion of the program in these directions and ensuring the necessary capacity seem essential.

Whatever type of microelectronic device we are talking about it is of fundamental importance to have computerized design methods (design technology) and

the technology for preparing the masks needed for manufacture. Working these out and creating the capacity necessary for manufacture is a central task of the program.

In the area of computerized design--based on various devices--we have programs and program systems developed here at home or originating abroad. The chief task is to develop a uniform system from these, create the necessary design workshops and train and employ a staff of designers to design concrete circuits.

In the area of preparing masks there is sufficient capacity for research and development now, but this must be expanded for manufacture. There must be a simultaneous significant development of methods to check the masks. Introducing the most modern technology, the electron ray procedure, constitutes an important part of the program.

In regard to microelectronic devices the program concentrates, in harmony with industrial development, on silicon based integrated circuits and discrete devices. Among these also special emphasis is given to various types of circuits developed for given items of equipment. In accordance with this, first place is given to those technologies which serve as a base for the production of such circuits (N-MOS, C-MOS and small capacity Schottky). We are buying the basic technologies from socialist countries (the Soviet Union and the GDR) and within the framework of the industrial program we must adapt these, and further develop them according to domestic needs, into a technological line capable of processing 120,000 75 or 100 mm diameter silicon slices per year. The level of the technologies to be used will be characterized by a line width of 5-6 microns, which lags behind the world level but for this reason will make it possible for the electronic industry to manufacture important individual circuits. At the same time, naturally, it will be possible to use technologies finer than this in research and development. The capacity of the technological line will make it possible to manufacture well selected catalog circuits in relatively larger series together with equipment-oriented circuits in small series. This will make necessary the development of a few other technological variants (e.g., technologies for linear circuits).

Discrete semiconductor devices represent a significant proportion in the production program, both in value and in number of units. The manufacture and development of these does not require extra investments, compared to the integrated circuits. Development here is directed primarily at working out ultra high frequency and high performance, high voltage transistors.

The planned volume for manufacture of integrated circuits and discrete semiconductor devices will make necessary expansion of the existing and modern base for assembly and measurement in Gyongyos and developmental activity connected with this is taking place within the framework of the program.

The development of automatic measuring devices for integrated circuits has been an important part of our microelectronic cooperation with socialist countries thus far. This theme will be continued within the framework of the program, which also has as a goal the development of computer controlled

measuring equipment for memory, LSI and VLSI circuits and of automatic measuring devices for signal technology, television and industrial analog integrated circuits.

Although it is not emphasized the program also deals with some types of microelectronic devices which are not based on silicon in areas where domestic research achievements are not far from the world level. The general goal here is to build up experimental manufacture in the interest of developing laboratory information into know-how.

In the area of insulation based (hybrid) circuits one direction of technology and design development will be the realization of equipment-oriented hybrid LSI systems, closely connected with applications research. Other directions are represented by research aimed at development of microwave hybrid integrated circuits, integrated optics and some indicators and sensors.

In the area of GaAs based devices the Schottsky diodes and Gunn diodes will reach the level of experimental manufacture in this plan period; the devices will be built into microwave mixers, detectors and oscillators. The development of prototypes of FET transistors, microwave high performance MESFET devices and microwave monolithic integrated circuits will provide a basis for later experimental manufacture of parts for future types of communications equipment.

Research and development in the area of magnetic bubble memory has as its chief goal the development of and initial experimental manufacture of storage elements with a capacity of 256 K bits. On the basis of the technical and economic experiences with experimental manufacture it will be possible to decide concerning implementation of industrial manufacture. Parallel with experimental manufacture there will be research in the interest of increasing storage density and reducing costs per unit of storage capacity.

The Course of Execution of the Program

Five enterprises (MEV, EIVRt [United Incadescent Lamp and Electrical Company], REMIX, MOM [Hungarian Optical Works] and EMG [Electronic Measuring Instruments Factory]) and two research institutes (MIKI [Instrument Industry Research Institute] and TKI [Telecommunications Research Institute]) of the Ministry of Industry, three research institutes of the Hungarian Academy of Sciences (KFKI [Central Physics Research Institute], MFKI and ATOMKI [Nuclear Research Institute]) and several faculties of the BME [Budapest Technical University] are participating in execution of the program, which consists of six sub-programs. Additional enterprises can be expected to join in the event of the expansion of the program outlined above. The recently created Microelectronics Enterprise (MEV) is responsible for silicon technology, one of the key sub-programs, and is also the most important participant in the entire program. The KFKI is responsible for computerized design and mask preparation. At the level of organs with national authority the first secretary of the MTA and Mihaly Sandory, government commissioner for microelectronics, appointed by the minister of industry, are responsible for the program. Sandory also directs the entire microelectronics program of the EKFP. Practical guidance

and coordination of research and development is the task of the program commissionar, the author of this article.

The work of those responsible for the programs is aided by a program council made up of representatives of the financing organs and the enterprises using the results. The Microelectronics Technology Committee of the MTA works with the program commissioner as a professional advisory body.

About 60 percent of the financing for the program comes from central sources and 40 percent comes from the funds of the cooperating enterprises and institutes themselves. The central financing contributions are paid to the central account of the program; the program commissioner signs research and development contracts charged to the money collected here, and thus one-channel financing is ensured.

Precise execution of the large scale, complex program in time and content can be imagined only with flexible, "sliding" planning and continual, determined supervision. Development of the planning, information and supervision system needed for this is not yet complete.

In the case of two sub-programs connected with the development of silicon based integrated circuits--which constitute the backbone of the entire program--it is worth noting the essence of the division of labor between the Microelectronics Enterprise and the research institutes of the MTA. The executor of the microelectronics program of the EKFP the MEV naturally plays a central role in execution of the OKKFT program also. In the first phase of the program the KFKI, exploiting its favorable conditions, is undertaking a significant part of the developmental tasks aiding the timely initiation of production. In the second phase it will gradually turn in the direction of research activity laying the foundations for attaining more distant goals, developing a division of labor which will be desirable in the long run also. The MFKI and the ATOMKI are participating in tests connected with technological processes, using unique, highly instrumented testing methods.

Summing Up

The microelectronics program of the OKKFT is a research and development program supporting the nicroelectronics part of the EKFP, the realization of which is of very great significance from the viewpoint of the domestic electronics industry. The program started with a significant delay and total fulfillment of it is improbable--primarily because of a delay in investments--but some reduction of it can be hoped for with organized work. A further delay in investments would endanger the success of the program.

Only a few months have elapsed since execution of the program was started so, naturally, one cannot yet evaluate the technical results. It is even early to given an opinion about the functioning of the new forms of organization, financing and guidance but it can be noted that in addition to the advantages of program-like guidance and one-channel financing there has been an appearance of elements of bureaucratization the elimination of which will require significant attention and effort from program guidance.

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ROLE OF MATERIAL RESEARCH IN MICROELECTRONICS

Budapest MAGYAR TUDOMANY in Hungarian No 11, 82 pp 875-877

[Article by Ivan Szep: "Role of Material Research in Microelectronics"]

[Text] It is already sufficiently well known that microelectronics is the material carrier of the present unheard of development of computer technology, informatics and automation. Parts of ever smaller size and ever more complex construction are appearing in the arsenal of microelectronics, making possible the swift and complex solution of the various functional tasks of electronics (generating, transmitting, storing, sensing and processing the signals bearing information).

Microelectronics today has become virtually the symbol of technical and economic development. Its effect throughout the world has become such a compelling force that even the industrially less developed countries cannot ignore it. The resolution of the Council of Ministers concerning the Electronics Central Development Program (EKFP) passed last year will hopefully strengthen this developmental process in our homeland also.

The fascinating achievements of microelectronics--let us think only of the enlarged pictures, appearing so often in the press and television, of integrated circuits consisting of a hundred thousand elements of a few thousandths of a millimeter in size on a silicon chip 1/4 centimeter square--can be attributed basically to two factors: the unexampled development of material technology based on a knowledge of material properties and the development of manufacturing, testing and measuring equipment and devices keeping pace with it. Tens of thousands of researchers and developers throughout the world are working on the constant development of these two factors as demanded by the requirements.

Our domestic conditions today offer us the possibility of progress primarily in the area of materials research. But this area also is so broad and diverse that only on the basis of very careful judgment can we select tasks which promise results of international significance.

For several years research has been conducted in the Technical Physics Research Institute of the MTA [Hungarian Academy of Sciences] on a group of materials of fundamental importance in microelectronics, the physical and

chemical properties of semiconductors, with special regard to their role in various microelectronic devices.

The researchers of the institute have reported at a number of international conferences and in foreign professional journals about those new results they have achieved in studying silicon covered with an insulating layer, as an electronic system. As is well known, this system is the basis of a family of integrated circuits used in a very wide sphere, the so-called M-I-S (metal, insulator, semiconductor) circuits. These studies dealt primarily with the electric stability of the insulating layer, clarifying the factors and environmental conditions influencing them. The results achieved are of significance from the viewpoint of the technology of information storage devices or memories based on semiconductors. In these devices information is created by electric voltages imposed from without or is carried by charges displaced. The durability of the electric state thus produced depends on the chemical, structural and other properties of the material, so that knowing and influencing these is indispensable for satisfactory operation of the device.

Research being conducted at the institute has brought new and important knowledge about the properties of M-I-S systems with double insultors. With suitably selected insulating materials (silicon-nitride, silicon-oxide, aluminum-oxide) with double layers thus formed are capable of storing information permanently even if the electric voltage is terminated, after the necessary one-time voltage impulse. The studies done at the MFKI [Technical Physics Research Institute] showed how these double layers should be formed so that the charge can be stored for even 3-4 years and offered insight into the mechanism of charge storage connected with the chemical structure of the insulators. In the course of a study of the material mutual effects arising in microelectronic devices based on silicon the researchers of the institute called attention to the role of the metal component of the M-I-S system, pointing out that the effects previously considered secondary (e.g., the composition of the remnant gas) in the customary creation of the metal layer (e.g., by means of vaporization) also have a significant influence on such properties of the metal layer as crystal structure and particle size.

For a considerable time research has been conducted at the institute in the area of the physics, chemistry and technology of A^{III} B^{V} type compounds. The semiconductor properties of these was discovered in 1952. The best known representative of them is gallium arsenide (GaAs) arising when elemental gallium and elemental arsenic combine. Other members of this family are formed by the combining of aluminum, indium and gallium with antimony and phosphorus as well as arsenic (AlAs, GaP, InP, InSb, etc.). By introducing appropriate additional materials these compounds can be used to make devices which emit radiation in various wavelengths under the influence of an electric current. Those radiating in the visible spectrum range (yellow, red, green), the so-called illuminating diodes, are known from the displays of pocket calculators and the display colors of TV sets. Of greater significance from the viewpoint of technical use are devices radiating in the invisible, infrared range, which form information transmission light emitting elements with the mediation of glass fibers (fiber optics). This is also the basis of the swiftly spreading optical communication.

Research being done at the MFKI is directed at producing primary materials with such properties, studying their characteristics and preparing prototype devices. The results achieved in connection with the study of factors determining the life expectance of illuminating diodes are recognized even internationally. They have established, for example, that structural faults in the primary material significantly decrease the life span to be expected, which is also a function of the strength of the current used. For this study researchers of the institute worked out a special measuring instrument which has won professional recognition even abroad. An important task in connection with optical information transmission systems is quality control of the glass fibers themselves, for which the institute's researchers worked out an original measurement classification with which they can satisfy domestic needs of this nature.

Important from the viewpoint of studying and influencing the use properties of semiconductor compounds of the $A^{III}B^{V}$ type is research aimed at discovering the material nature of so-called deep levels, with an energy greater than 0.3 electron volts, where significant new results have been achieved. It is possible that with the deliberate creation of such systems it will be possible to develop new, highly sensitive microelectronic storage and processing components for informatics.

Despite the swift shrinking of the size of microelectronics parts the informatics systems made from them still require significant space, because of the power units, background storage and other auxiliary equipment. The increase in the number of calculation operations to be performed per second also increases the bulk of the system. The need for greater speed and smaller power supplied has put on the agenda research in semiconductor materials and systems more advantageous than silicon from the viewpoint of these properties. It appears at present that gallium arsenide can be expected to inherit this role, because the speed of integrated circuits, special devices, which can be prepared from it is 3-4 times that of silicon devices, with power needs smaller by 30-40 percent.

Among the possibilities research being done at the MFKI is dealing with questions of the formation and functioning of the so-called Gunn diodes (the signal transmission time is a ten billionth part of a second). They have worked out the quality requirements of the primary material and a method of producing the diodes with simultaneous checking of quality. Studies dealing with the transformations taking place at the time of eutectic alloying of gold and gallium arsenide have led to fundamental discoveries in materials science. It was discovered that the arsenic vaporizes in the form of molecules despite the fact that alloy formation takes place under the decomposition temperature. This process is accompanied by characteristic resistance changes.

Integrating Gunn diodes with transistors offers the possibility of developing circuits of such high speed that it will be possible to build information processing systems of greater capacity than heretofore.

The swift development appearing in the area of integrated circuits has virtually forced into the background other branches of microelectronics. But

semiconductor materials, however important they may be, made up only a small part of the family of solid bodies. Their prominent role can be attributed primarily to their special electric properties. The ever-increasing use of light as an information carrying medium directs attention to those materials which show properties suitable for receiving, storing or transmitting information in a mutual effect with light. In reality we do not yet even know all such properties, which we find not only in classical crystaline solid materials but also in materials with special atomic or molecular structures such as liquid crystals, an entire series of amorphous materials and in materials with a layered or threaded structure (for example, organic synthetics).

In these areas of materials science, now under study, the theoretical foundations of classical physics offer little support. New methods of discussion are needed. An example is the percolation theory, further developed by theoretical researchers at the MFKI, which makes possible a description of the physical properties of material systems consisting of granules as a function of their density. The condensation taking place as an effect of heat creates macroscopic properties deviating from the microscopic properties of the granules. The new theory makes possible a preliminary calculation of the static or electric properties of metals, ceramic materials and amorphous semiconductors.

Of great significance are the crystaline materials with asymmetric crystaline structure which change their size in an electric field or produce an electric voltage as a result of chemical influence. Their light transmitting ability can be changed under these same influences also. An example is lithium niobate, which can be used to store or process information arriving as light. Research done at the MFKI was especially successful in the study of the properties of waves, propagated at the speed of sound, induced on the surface of lithium niobate and in the practical application of these.

The achievements listed convincingly prove the role of material research in the development of microelectronics. In the years ahead the research of the MFKI will keep in mind this interdependency, justified by practice.

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PRACTICAL ACHIEVEMENTS IN APPLIED MATHEMATICS, COMPUTER ENGINEERING

Budapest MAGYAR TUDOMANY in Hungarian No 11, 82 pp 877-879

[Article by Andras Prekopa: "Practical Achievements in Applied Mathematics, Computer Engineering"]

[Text] In what follows we will describe four applications, very different from the viewpoint of both the area of application and solution methodology, to characterize the work being done in the Applied Mathematics Main Department of the SZTAKI [Computer Technology and Automation Research Institute].

In the Operations Research Department they have prepared, as a result of several years of work, a mathematical model and computer program system which is suitable for optimization of the daily schedule of national electric power production.

Determining the daily schedule of electric power production means providing, for every period of a day (in our case this means periods of half an hour or an hour), how much machines or machine groups--in common usage, which operational modes--in the most significant thermal power plants of the country should be operated and what output level in order to satisfy the electric power needs of the country.

Preparing the daily schedule always takes place on the day preceding the day in question, when the electric power need can be estimated with a precision of 1-2 percent, and when it can be determined what equipment in the power plants can participate in production and over what grid the electric power produced can be delivered. The schedule--that is, the combination of operational modes and output levels to be used in the several periods--is good if the power produced in every period can be delivered to the consumers, thus if the conditions taking grid relationships into consideration are fulfilled.

Several good schedules could be prepared for a given day; of these, we call that one optimal the use of which produces electric power at minimal cost. By cost of production we mean the cost of the fuel used, of heat loss and substantive deterioration deriving from switching equipment and of grid loss.

The mathematical programming model developed to determine the optimal schedule was an enormous, linear, mixed variable task. By the latter we mean that the

mathematical formulation of the task outlined involved, on the one hand, variables which could have values only of zero or one (these characterize the operational modes) and, on the other hand, variables which could have optimal values between two given limits (in the case of a given operational mode these characterize the level of production). Both the target function describing costs and the incommensurable system representing limiting conditions are linear. Some of these are nonlinear in the theoretical formulation but it was possible to approximate them with suitable precision with linear functions or incommensurables. The large scale means that we have about 2,000 conditions; the number of continuous variables is about 1,200 and the number of discrete variables is about 400.

To solve the problem it was necessary to work out special algorithms, in addition to preparing a suitable data base. The algorithm works on the principle of decomposition--that is, the solution of the problem is reduced to a sequence of solutions of a number of smaller problems.

This method of determining the daily schedule is among the most modern even on a world scale--according to our foreign experiences. The program has been run successfully with real data, but there is a need to speed up the solution time before practical application. This work will soon be completed.

The development of the model described above was initiated by Andras Prekopa, chief of the main department, and Agoston Nemeth, of EROTERV [Designing Enterprise for Electric Power Plants]. Bela Protecz (MVMT [Hungarian Electric Works Trust] and Beata Straziczky, Janos Mayer, Istvan Deak and Janos Hoffer (SZTAKI) joined later.

For several years the Mathematical Physics Department has been dealing with research to aid mining safety and productivity. In regard to its tasks and methods this has been adapted to the conception developed by the Mecsek Coal Mines and the Deep Structures Research Department of the Hungarian State Lorand Eotvos Geophysics Institute, and serves to provide a theoretical mathematics foundation for it.

The ratio of mechanized front working has increased significantly in coal mining in recent decades. Installing modern machines ensures swifter progress, greater output and, in the event of suitable preparation, economical production. But setting up (and then disassembling) the machinery is expensive, so the production system can ensure the potential advantages only if it operates at full capacity for a relatively long time. It is a condition for this that it be installed in "undisturbed" coal deposits of sufficient size.

One method for a preliminary survey of a coal deposit is to induce and measure elastic waves in the mine galleries. The induction, carried out with special equipment, leads to the development of several types of elastic waves. In part these are scattered, in part they are reflected from the boundary between barren rock and the coal deposit, from the walls of the galleries, etc. Because of this sensors placed in a neighboring gallery or galleries register a complex wave picture. By evaluating these pictures one can conclude certain properties of the coal deposit between the sites of induction and

registration--for example, continuity, possible intervention of barren rock and greater or smaller fractures. All these influence the possibility of continuous front working.

The speed of propagation of an elastic wave in coal is smaller than in the surrounding barren formations. Because of this a so-called "channel wave" develops at a certain distance from the induction; the coal layer acts as a sort of wave guide. According to measurement experience the energy of the channel wave is a good bit smaller in the event of barren encasements or other disturbances than it is in an undisturbed homogeneous coal layer. But the energy can be decreased by other factors also, such as a thinning of the coal layer.

With the aid of a numeric solution of the partial differential equations describing wave propagation one can establish in advance what wave field we can count on the development of in the event of different conditions, or what wave reception will probably be recorded by the registering equipment. Naturally, the mathematical modelling can only approximate reality. Still, it can aid the recognition of potential utility and provides points of view for setting and evaluating the measurements.

This work was done for SZTAKI by Mrs Attila Mesko.

Since 1973, colleagues from the Operations Research Department have participated in the development of computerized production guidance for the Danube Iron Works. The work was brought together by the Danube Iron Works itself and a number of institutions in addition to SZTAKI had a greater or smaller role in it.

A greater possibility for development opened up when the Danube Iron Works got its own first computer in 1975, an R-20 computer. This was followed later by an R-40 computer.

The department joined in the production guidance work of the cold rolling works. The important factor in this choice was that the cold rolling works can be found at the end of the main technological process, the most valuable products come from here, here one can sense directly the needs of the market. Thus, the needs of this plant must determine the work of the plants coming earlier in the technological chain.

We worked out a multiple level, dynamic production guidance conception. The several levels are distinguished by the length of the time interval for which we defined a production task. The levels examined by us were the following: production planning (one month), production scheduling (one week) and production programming (8-24 hours). According to the conception adopted the various levels are in constant contact with one another.

The production scheduling and production programming systems posed a number of interesting mathematical problems such as, for example, optimal loading of the heat treatment positions, the division of labor among parallel items of equipment, assigning technological cycles (a work order task), and grouping

the ordered narrow bands which could be made into wide coils with minimum waste. A significant number of these tasks are cutting, grouping, scheduling tasks which can be conceived of mathematically as so-called discrete programming tasks. Efficient solution of these problems was possible only by exploiting the special structure of the corresponding combinatory problems, using ad hoc algorithms. The results received a significant role within the entire system. Laszlo Bela Kovacs initiated the development of the multiple level production guidance conception and he guided the additional work for SZTAKI. This was contributed to, on the part of the Danube Iron Works, primarily by a collective led by Laszlo Mudra. Those from SZTAKI who joined the work were Bela Vizvari (as operational guide from 1978), Miklos Biro and Endre Boros.

A stockpile management program package was prepared also, developed partly at SZTAKI and partly containing an implementation of models taken from the literature, which can be used for every product included in management at the Danube Iron Works. The program package was prepared under the leadership of Peter Keller.

Taking the experiences gained into consideration the Danube Iron Works decided to create a comprehensive integrated guidance system, which will be prepared within the framework of a Danube Iron Works-SZTAKI Research, Development and Production Association formed for this purpose.

Since 1977 on a commission from the MTA [Hungarian Academy of Sciences] and beginning this year within the framework of the OKKFT [National Medium-Range Research and Development Plan] we have been dealing with a mathematical description and computerized processing of the vegetation nutrient over-burdening (eutrophycation caused by phorsphoros and nitrogen) of the Balaton in the interest of developing a proposal aimed at improving the condition of the lake and its water-shed. Our chief achievements are the following.

We modeled the burden affecting the lake with a stochastic process and on the basis of this we described the algaezation with a model based on a system of differential equations. With the aid of multiple variable time series methods, combining and grouping the development/developmental indexes, we rank-ordered the problems and prepared a short-term forecast. The work was led by Janos Fischer.

A discrete programming model and program system were prepared to plan Balaton sewage treatment systems. The way this works is that first a list of possible main collection systems is prepared, then, from these and from the given sewage treatment plants, one selects the best solution to satisfy the given conditions according to the goal chosen. The work was led by Laszlo Bela Kovacs.

We have developed a dyanmic level control model based on a many year time series of volume of water flowing into the lake, precipitation and evaporation. The quantitative results obtained are very favorable and show that in a very large number of the periods studied (months) it is possible to maintain the water level within the prescribed limits. This procedure is the achievement of Andras Prekopa and Tamas Szantai.

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EVOLUTION OF DEVICES PROMOTING USE OF MICROPROCESSORS

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[Article by Laszlo Schnell: "Development of Devices Aiding Use of Microprocessors"]

[Text] As a result of the appearance and spread of microprocessors, or the LSI technology, the upper limit of the complexity which can be built into equipment has increased by several orders of magnitude. This has created qualitatively new products or product families with much greater capacity than before such as, for example, programmable machines (NC machines, robots, etc.) and instruments (automatic measuring devices, testers, etc.). In the years ahead these will significantly influence the industrial development of the world and thus, naturally, the development of domestic industry also.

The creation of microprocessor systems is a good bit more complicated than that of systems representing earlier levels of development; without a suitable initial stockpile of devices and a developmental background the development of these systems if virtually hopeless.

Significant aid to the solution of this problem is offered by the so-called MMT [Instrument and Metrological Faculty] microprocessor applications system developed by the Instrument and Metrological Faculty of the BME [Budapest Technical University]--on a commission from the MEDICOR Works--which makes it possible for users to bypass the basic steps of development and concentrate their resources on the special problems of the given applications area. This initial level and background, supplied from "outside," provides the following:

--to a rational degree it forces standardization within and among enterprises in the interest of using universal hardware and software elements to as great a degree as possible for various developments;

--it supports the spread of efficient software development methods;

--in addition to the necessary background it contains elements of such fundamental importance as a manufacturing and final control and service system, a documentation system and educational questions connected with enterprise introduction and maintenance of microprocessor techniques, thus an integrated planning, manufacturing and control (TGE) system; and

--from the industrial law viewpoint it is suitable for creating products which can be exported.

Ten large enterprises or cooperatives are using the MMT system at present.

Thus far about 45 types of apparatus or systems (various biological signal processing systems, chemical automats, telemechanical systems, measurement data collectors, picture processing machines, etc.) have been developed with the aid of the MMT system and additional industrial applications are under way also.

MEDICOR manufactures the system element cards--the basic hardware units of the MMT system--and the TEX-ELEKTRO Cooperative manufactures the developmental system--which is the basic tool for the developmental background.

An MMT Users Association (MMTE) has been established by the enterprises using the system for the purpose of aiding industrial applications of the system, its further development, optimal use of intellectual resources and the attainment of even greater economic results.

The chief characteristics of the user environment taken into consideration in the development of the system were the following:

--a heterogeneous, non-computer product structure,

--small and medium series size, and

--medium to high complexity equipment.

In accordance with this the chief parts of the MMT system are:

--functional hardware and software elements for microprocessor equipment,

--a developmental background,

--a manufacturing and final control and service system, and

--a documentation system.

The MMT hardware system is a hierarchically standardized modular system. When creating it it was fundamentally important to fix the appropriate standards; this also makes it possible to ensure compatibility among the several elements of the system.

The following levels of standardization exist in the MMT hardware system:

--architectural level, which fixes the structure of single or multiple processor devices;

--functional-logical level, which fixes the functions of the standard hardware modules, the functional and logical specifications of the bus linking the modules, etc.; and

--mechanical and electric level, which defines the mechanical and electrical parameters of the bus and of the hardware modules.

The MMT hardware system has a multiple card structure where a bus connects the cards independent of the processor. Going beyond a single processor system, it is possible to create multiple processor systems by using special bus connection cards.

The hardware system exists in several implementations, which are compatible from the viewpoint of the architectural and functional-logical level but which are different in regard to their mechanical and/or electrical parameters or in regard to the parts base used.

The conditions of the user environment have a great influence on the development of the software system. The software system realized can be broken down basically into two main parts. The first part contains the languages and corresponding technology which support the development of the background programs. The second part contains languages which can be used for program development for intelligent devices, the software technology connected with the languages and the software modules which can be built into the devices.

Device software development is built primarily around the assembler level but there is also a technological background making possible use of high level languages (BASIC, PASCAL) for device development purposes.

The software elements include system programs, special libraries and program packages.

The developmental background. A unique multiple level system supports the development of device hardware and software. The developmental tools and methods make possible both "cross" and "resident" development.

The cross development system, which works on a PDP 11 computer, supports software development. Combined hardware-software development and the development of resident software are provided in the system with use of the MMT-DT80 developmental terminal.

The so-called small developmental monitors support smaller scale software developments and hardware element developments (card development).

Both the developmental monitors and the developmental terminals can be connected to a time-sharing computer (PDP11), creating a distributed intelligence developmental network in which the computer background ensures the efficiency of program development (creating the possibility of algorithmic simulation). The developmental terminal and developmental monitors make possible the testing, restoration, etc., of hardware proximate and real-time tasks.

The appearance of LSI elements and especially of microprocessors has significantly changed the requirements made of testing and service as compared to traditional analog and digital electronics. The hierarchical structure of manufacture demands hierarchical testing, the levels of which are parts

testing, card testing and final testing. In the case of microprocessor devices all these are joined by an additional essential component, self-testing and self-calibration. Although testing must begin at ever lower levels, in most cases effective parts testing (testing LSI elements, microprocessors, etc.) is possible only if one knows the data in the possession of the parts manufacturer (the internal structure of the parts, etc.).

In the MMT system the central element of the control system is the testing of the system element cards. Reviewing the possibilities for card testing it seemed useful to develop a special tester instead of using a universal testing automat; the special tester can test only cards fitting on the MMT bus.

The primary purpose of card testing is to sort the good and bad cards (a go/no go test), but in addition the equipment offers effective support for fault diagnosis.

The other elements of the test system, such as device test, self-test and service, rely to a significant degree on the card testing.

The purpose of the documentation system is to ensure the manufacturability of the elements of the system, fix the technological background for further developments compatible with the system and provide the information needed for efficient use of the hardware and software modules creates in the system. Let us mention a few elements of the documentation system as examples:

--the manufacturing documentation for the hardware system elements was prepared using the A UTER system,

--in addition to the manufacturing documentation, 30 to 80 pages of developmental documentation have been prepared for every system element card, containing information about the cards needed by device developers.

A variety of hardware and software design or programming handbooks and documentation handbooks ensuring the uniformity of the documentation system constitute essential parts of the documentation system.

8984
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IMPACT OF INFORMATION EXPLOSION ON SOCIETY

Budapest MAGYAR TUDOMANY in Hungarian No 11, 82 pp 796-802

/Article by Academician Tibor Vamos, director of Research Institute for Computer Engineering and Automation: "Information and Society"/

/Text/ Long before the concept of information was born in our world, man understood the significance of this concept. He was separated from other living creatures by his ability to speak, and history was born at the beginning of literacy; it has been observed that societies can be born only through an exchange of information, be that sound, graphic symbol, gesture of motion or even smell. Information consciousness also developed early, every human organization developed its own forms of acquiring, transmitting and generating information and the functions serving these ends. It was discovered early that possession and transmission of information yields the same power as physical force or weapons and that a more rapid transmission of information yields an advantage in power to the organization. It is traceable from the earliest times that the development of historical formations depended almost as much on potentials of information transmission as on production or trade. The sailors of the waterways and the fast horse riders of the steppes were the first organizers of political formations acquiring larger territories.

It is easy to trace the changes which were created in humankind's history by information transmitters and fixers: writing and duplication (printing), but also papyrus, clay boards, engraving, printing plates. Connected with power structures, and parallel with the development of information transmission, the monopolization and manipulation of information also developed; documents that were declared apocrifs are probably as old as the documents themselves, censure as old as writing. Societies' processes of biological survival and procreation are closely connected to the transmission of information between generations (this also since the higher forms of animal life); the same can be said about the connection between teaching/education and power. What is then that has changed by our time, why has information come into the center of interest today?

Many views are, of course, possible which represent various lines of thought; one fact is, however, irrifutable: information, which organized and kept together human society and which has been present from the beginning, is going through a kind of extraordinary transformation, the consequences and main

characteristics of which is just as difficult to assess as it is to assess history's other significant changes. It is precisely the change in the role of information which makes us return, in connection with the important phenomena, to this conscious and deliberate uncertainty.

The first change, which may be the one that is most generally acceptable, is the technical possibility to make information almost instantly available for everyone. As we have already written about this earlier elsewhere, the technical conditions have been created through which every information of the world that can be drawn or can be fixed in sound is available to every place of work and every citizen (home). This technical process began its glaring career in the past years; extraordinary results can be shown in any institution that is well equipped with computer and communications equipment, the perspectives formulated in our definition will be essentially realized in this decade in the most developed industrial nations, and the lag in the moderately developed countries probably will not be more than 5-10 years. A counter-argument could be that information coming from anywhere was in principle available for everyone (even if not to the extent that it is today) through mail or even through the telephone discovered in the last century; if it was not hindered by other circumstances, the newspapers of every country was available through mail, and it was possible to borrow books or copies from any library.

This possibility, which was generally available only to the affluent or those who persisted, is now being delivered to home in a comfortable way by the new technology. The significance of information--no matter whether it is about scientific or technical data or about political, marketing or trade conditions--is quite different when it becomes available only through a search that may take months or when the answer to a question is instantly available on the TV screen at home. It is one thing to find data through an extensive search (examining many books and other sources of information), and quite another when the data are organized by means of modern data processing and thus the search is fast and simple, and possible for any intelligent person. Of course, this entails the danger that man becomes inundated and overburdened by the huge amount of available information and, as a result, becomes closed to, and tries to escape from it. But it can also mean that the selective and editing processes, that are indispensable for organization, temper with and falsify truth according to alleged objectivity stemming from information hardware, in a way that not even the most extreme propaganda could do earlier. We will come back to this danger and the ways of dealing with it which is offered precisely by the development of information technology.

The second change, which I think is important, takes place in human work. This process is also old; as the division of labor became more complex, the number of hands, which are generally needed but often are superfluous, increased; they do not take part directly in the production of goods but take care of the fixing, transmission and explanation of the related information. Officials, lawmakers and lawyers of the various communities, messengers and scribes, comptrollers and teachers, who transmit information from generation to generation, churchmen and tradesmen were all parts of this process.

This interaction, which I compared in an earlier study with the development of the nervous systems of living organisms, has become so great by our century that people began to see a social danger in its independence, self-multiplication, and occasional lack of function. I see two aspects of this modification. One is that it became possible to use machines for the mechanical part of this activity related to information transmission, and thus man's role is clear and separated from the mechanism. The other is that man's role in production becomes more and more that of transmitting and formulating information to the machines: the operations are carried out not by man but by the machines, man "only" telling the machines through means of information transmission, data, or sound, what to do. If we look at this process pathetically enough (posterity may indeed corroborate this state of mind), then we can say: the time has come when man is doing only human work; most mysticisms related to work, and the social organization and meeting of demands vanish; the picture of man, the individual, with his needs and his cooperation in meeting the needs of others, and the physical and organizational machine of transmission becomes clearer. The process of the modification of human work is characterized by an estimate that about half of the people in the U.S. are working today, within the various activities, by handling information.

It is customary to mention the menacing danger of unemployment among the social effects of the wide proliferation of computer technology. Experience in countries that employ the most advanced computer technology does not corroborate this fear, however; computer technology--as it was mentioned earlier--creates at least as many new jobs as it abolishes. It does not decrease the number of jobs, it only changes their character. Incidentally, in a few earlier talks given in countries that have a much more advanced computer technology than that of Hungary, I expanded on the view that, for affluent countries, unemployment is a political and economical question; for poor countries, it is a problem that cannot be solved. Thus the danger in Hungary is not that the proliferation of computer technology will entail unemployment but that the slow development of computer technology will make us relatively poorer, and that is why we will have employment problems.

The two aspects described above are generally accepted. The following are perhaps newer concepts. The third is the possibility for a dialogue. With the development of human civilization and the growth of organizations, the thinking part of mankind developed an ever stronger nostalgia for times past when people lived in smaller and clearer communities in which they were able to know each other well, everyone could be informed of community affairs; the Greek ideal of the city state, the agora society (which is idealized in our nostalgia but really existed) could be developed in which the democracy of a small circle could be implemented in reality in the form of direct dialogues. Instant reply and the possibility of getting information rapidly from everywhere make bilateral relations possible again. The agora is replaced by computer networks. What I am talking about here is, of course, only a possibility, and within limits. It can be asked right away whether society or any organization will become more democratic and characterized by dialogues if the questions are directed not to another person, a scribe or official but to a machine which can give, beyond a certain point, only prefabricated, stupid answers--if it does not indeed, totally break down. I can show the possibilities through

the examples of the operators of well-working telephone networks. If the telephone network is good and gives a wide range of automatic services, then enough operators can be freed to answer all questions that must be answered by humans or need human assistance. Everyone who has made calls in such networks could see this. A possibility for dialogue is given, and history shows that man will, sooner or later, try to make use of a given possibility.

The fourth factor involves a beneficial negative result. Fanatics of the rigid directive organization, in spite of their conservative views, were very happy to see the possibilities offered by computers. Their hope was that the computers, with their huge capacity for storage, processing and directive mechanism (through networks), will overcome the obstacles that became more and more apparent in the nationwide--and international--rigid directive system in which everything is planned in detail. Ten-fifteen years ago one enthusiastic study came after another showing how planning for the entire society should be done in the future with the aid of computers. It is a very significant negative result that it was this monster that crumbled, and through its crumbling, it showed the way toward more developed forms and systems of organization serving man and society, originating from new possibilities in technology. For it became clear very rapidly that the number of interconnections in large systems, or within individual parts of systems, is so huge (even if the stochastic changes, present in every part of a system and in every connection, are disregarded) that the presently available equipment, or even the fastest computer using the Earth's every molecule, cannot process.

This conclusion is actually trivial. If we consider that it was shown in every book on combinatory written for children several decades ago (e.g., Rózsa Péter's excellent book, Play with Infinity) that not even the problem of chess—the rules of which is based on relatively simple algorhythms, and which has a small number of pieces and a limited number of moves—can be approached with the help of combinatorial or logical methods within a sensible (i.e., humanly attainable) amount of time, it should have been clear to everyone that really large systems, or problems in managing large economic and social units, cannot be dealt with in their entirety.

Still, it was necessary to feel out the practical limitations of computer and information technology in order to recognize this; and, of course, this recognition was helped by the breakdown of ignoring simplified models and multiple factors--originating perhaps from the 18th century's naive rationalism which showed its effects even in our century, that everything can be deduced from a few basic models and laws and thus it is possible not only to follow and explain phenomena but also to make prognoses with enough certainty. By sensing the limitations of the immense possibilities in computer technology, we succeeded in strengthening this deduction on which we can look back today as trivial, although the great dialectic thinkers had successfully formulated these thoughts in the 19th century through their thoughts on the stages of quantitative and qualitative changes and infinity.

The paradox remains there, though. On the one hand, the world has become in many respects a unified system in which every element has its effects on the other (often in a form that is clearly definable) and in which long-range

planning and thinking, precisely for this reason, will play an even larger role (e.g., international economic, and technical/scientific cooperation has become indispensable); on the other hand, we are faced with the question of the impossibility to manage large systems. The development of information technology shows a huge step toward the possible future forms of organization and system technology, even if it cannot show the way out of this paradox that solves everything--such a way does not exist.

Both the model and the way to solve the problem is given by the present development of computer technology and information transmission. Even the centrally controlled, hierarchically built large computer systems broke down more and more often. It was characteristic that the ever-larger systems--and the organizations controlled by them--became self-administrative, inefficient and ever more independable and complex, just as large organization become excessively bureaucratic. Decentralized, divided and cooperative systems become more and more the main models for computer technology and the connected information networks and for the management of large industrial processes. These cooperative systems deal autonomously with everything that can be dealt with within the given unit, they store their own data, they themselves process local information. This is made possible today by the extremely low price of processing and storage equipment. There is no need whatsoever for any kind of dentralized system to do these functions centrally under the pretense of economic efficiency. The divided system element (not subsystem!) is connected by well-defined cooperative rules (so-called protocols) to all other systems that are necessary for carrying out the given task. This protocol does not prescribe anything with regard to the given internal function, but demands a great deal of discipline in the cooperation. This discipline is rather voluntary; cooperation is possible only for those who (by whom the system element is personified) strictly abide by the rules of cooperation--which are made mutually, on the basis of mutual interests and which are, from time to time, examined on the basis of contracts and agreements.

It is not incidental that one such cooperative protocol is called "fair play." This method of cooperation can be imagined, of course, only at a high level of information technology and in a high-level and civilized system of cooperation which went through the difficult school of the earlier, more rigid system technologies. It is impossible to create such a cooperative system without information channels perfectly suitable for the given tasks and without precisely defined cooperative rules or protocols. These cooperative systems are, however, proliferating--consciously or unconsciously--in traffic and information networks, chains of service, and in computerized and integrated planning and manufacturing processes based on flexible production systems. Thus the cooperative systems solve one of the key problems in information technology, namely, how systems can be managed if information on the system, its elements and function, is incomplete or so large that it cannot be processed. The paradox always provokes the new kind of questioning.

If we accept only as much from these diagnoses of change as a man open to new things with a certain amount of scepticism accepts, then preparing for these changes remains a compulsory question for every responsible citizen. The other articles of this volume deal with this preparation, the situation in Hungary, and the prospects. I want to emphasize here only a few aspects.

Education is perhaps the most important thing. For equipment will emerge faster than the people necessary for the equipment will. The Rubik cube competitions show that there are things that can be mastered only at an early age, and that there are talents that can be developed only at an early age. If we want to prepare ourselves in the next decades for a society that works and thinks in a new fashion, then it is imperative for us to show and teach the techniques and possibilities to those who will in fact use them.

The new growth careers are becoming general slogans in our thinking on economy and development. It must be more clearly shown that all means and systems that are connected to the revolution of computer and information technology will play an outstanding role among these new growth careers. The resulting improvement of quality often brings about a quantitative decrease (higher efficiency, less weight, longer life); more, and more varied, services cannot be fit into the earlier quantitative indexes but result in a very apparent development nevertheless.

We must seriously deal with the questions of socialist society using the information technology in a new way. It was already emphasized that the main purpose of information technology is not to mechanize the existing forms and structures but to provide new possibilities for the citizen and the state, for the individual and the organization. Hungary, with her characteristic social and economic development, is an ideal ground for these experiments, for decentralization--and the distributive/cooperative activity that points far beyond decentralization--is slowly becoming our main discipline of economic management.

The possibility of enterprise within a company is being discovered now in the capitalist countries; in Hungarian agriculture, this has been a general practice for more than a decade, and in industry, the recent statutes broaden this way. The main trend in our public administration is that in the process of decentralization and the reduction of hierarchical levels, local decision-making and extensive autonomy is strengthened. The automation of administration falls into this period, although we have not done enough in reconciling the thinking behind the two tasks. The experiments which were conducted for the automation of small-town administrations may be encouraging for the foundation of more general, modern system development which combines the organization, methods and techniques of administration. We need many experiments and trials, for we are making new paths, without the possibility to use old schemes; we have learned that carefully worked out and clean models do not work in reality because of the same reasons that make cooperative systems necessary.

One of our important tasks is to make an all-encompassing information law. At present we have defined only the contour and the tasks of the law. The similar laws of other, technically more developed and better organized countries can serve as models but cannot substitute for the characteristic, experimental, innovative road of Hungarian socialist democracy's development. The dialogue, the technical feasibility of information, and the development of the systems toward cooperation make it imperative for us to reformulate the relationships between the citizen and the organizations, i.e., between the

citizen and his employer, the citizen and local administration, the citizen and the state's high-level political leadership. Who and what can ask, who or what can be asked, and who is responsible, and in what way, to give the answer? How shall the dialogues be evaluated? What are the limits of mechanical, administrative and legal competence? These questions demand definitions which can be precisely algorhythmicized in the future, i.e., the limits of algorhythmicization must also be defined where it is taken over by responsible human--individual or collective--judgment. Similarly, we must reevaluate the relationships between the citizens themselves, both in the area of family relations and that of economic relations. For instance, does a person to be married have the right to find out about the partner's health, finances and other personal matters? What can one learn about the circumstances of another person of opposing interests, or about reasons for decisions made about someone else which may have a bearing on one's own interests? It is hardly incidental that we have no Hungarian word for the everyday English word "privacy" which is used in reference to the individual's own personel sphere. This is the way how even words sometimes reveal a nation's background in history and social organizations. Such a background will be an important contribution to the continuation of our characteristically Hungarian socialist way.

In the course of all of this work, equal rights will be better defined; it will be redefined what, in connection with separating the functions, rights are equal for the individual and the organizations and what are not.

At the same time, we must solve, in connection with state administration and the individual's responsibilities and rights, the problem of confidentiality. Of course, it would be unacceptable to make all data open to the public, this would be dangerous both for the state and the economic organizations, and for the individual. It would be important, however, to know--as much as possible--what data are confidential and why. We must avoid those situations where people do not know about confidential information nor do they know the reasons for confidentiality. Such a situation almost always leads to dangerous monopoly and uncontrollable abuse of power. The information law should also deal with the responsibility regarding the authenticity of the information.

The recognition that the making and transmitting of information is a product like any other product having a useful value, will bring about certain changes. We know that newspapers, books and documents are also products, but this appears in a different light in society when all of this will be present in all of our activities and in the same everyday form of service as electric power or water, with the only difference, however, that the related individual components of information come from different sources, from legally different makers, resulting from diverse labor inputs.

The above can be viewed only as a rough draft; we have talked enough about the consequences of the complexity of the present; the future is even more complex but it is indispensable to make undelayed steps toward it--in the form of thorough and continuous work.

9414
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ACADEMICIAN APPRAISES STATUS OF SCIENTIFIC RESEARCH

Budapest MAGYAR NEMZET in Hungarian 24 Dec 82 p 12

[Article by Academician Pal Tetenyi, member of Presidium of the Academy of Sciences: "On Scientific Research, Without Illusions and Prejudices"]

[Text] During the course of the economy's difficult test, many people ask the question nowadays: isn't the country spending on science beyond its means, hasn't the time come to adjust our demands and wishes in this area as well as to the realistic possibilities? I answer this question with another one: I ask, together with many thousands of Hungarian researchers. What does and what can domestic research do in the interest of decreasing our society's and economy's problems, to solve the difficult problems before us?

The means spent on research are recovered in various ways and forms. The effect of research results may appear indirectly or directly in increased national income, in improvement in the quality of life. Besides the directly measurable economic effect of a radically new medicine like Cavinton--not to mention the higher level of medical care--it also results in indirect effects by increased respect for the firm producing it, and for the entire domestic pharmaceutical industry. The research projects aimed at the broad-based introduction of so-called radioimmunological processes exert a social effect primarily through increasing the standards of health care. By means of hypotireosis screening of newborns it becomes possible to correct birth defects, by which each year a number of newborns can be guided onto the path of normal human life, and hundreds of families and relatives are saved from the immeasurable pain, which even dwarfs the significance of the otherwise large economic burden which society is saved from having to bear.

The results of other research cannot be measured at all by economic measures, but have a great effect on society. It is enough to refer to the Hungarian economic research begun in the mid-1950's, the results of which gained expression in the reform of economic management. Larger scale nuclear and isotope research also began in Hungary in the mid-1950's. These also produced direct economic results by the nuclear technological processes which spread in industry, and significantly contributed to the improvement of medical methods. But their effect manifests itself primarily in the development of a technical-scientific base without whose cooperation it

would not be possible to imagine domestic construction of a nuclear power plant. Today's experience thoroughly disproves those who, advocating the perspective of a "turnkey purchase" in the 1960's, wanted to declare domestic nuclear and reactor technology research unnecessary.

Even these few domestic examples illustrate that scientific research exerts a multitude of effects--scientific-informative, sociopolitical, ideological, cultural, and economic ones. Each of these effects have great significance and are indispensable in the life of modern society, even though these cannot be measured meaningfully in terms of clear numbers.

The results of Hungarian scientific research are now recorded practically everywhere in the world. If international ranking existed in the area of scientific publications, Hungarian researchers would be ahead of the researchers of a number of larger and richer countries.

The question of efficiency and results naturally have special significance primarily in direct economically oriented research. I consider to be excessive generalization the opinion according to which the economic effectiveness of Hungarian research and development is low. We do have a number of less successful research facilities and projects, but experience shows that in recent decades Hungarian development did basically live up to the demands placed before it by production.

Domestic research and development has a strong practical orientation--and our consistent research policy also plays a role in this. Today every second project is experimental development activity, every third one is aimed at achieving applied research results, and every eighth one is basic research (information gathering). In light of these facts, we can only consider the statement--heard, unfortunately, even now at times--that researchers pay little attention to economic tasks, that "they do research for their own amusement," that "they work for results nobody needs," etc., to be prejudice that lives on as a memory of times long past. The research institutions and academic chairs spend 70 percent of their research funds to meet specific tasks within the framework of orders from enterprises and state assignments. The researchers work on orders they receive and on tasks to which they are assigned.

The entire research-development-production organism is interlaced by thousands and tens of thousands of contracts as by a network of capillaries. We could cite many examples for how domestic development has contributed to the relationalization of material and energy consumption. But we are not satisfied with the results. Results that can be considered new in international respects can be found to only a modest extent among developments successfully implemented in practice, and the role of science is characterized primarily by cooperation in the introduction of results, and to only a lesser extent by the introduction of new results.

Results of the activity conducted in some of the research institutions, and the excellent instruments and equipment developed there and produced in small numbers, prove that the reason for this phenomenon must be sought

elsewhere than in the lack of success of the research institutions. Domestic research is also capable of achieving outstanding technical results. It was 10 years ago that the graphic display--a computer technology equipment of extremely high intellectual and technological level--was developed for the first time in Europe in the Computer Technology and Automation Research Institute. In the Central Physics Research Institute the very modern method of producing integrated circuits by the ion implantation technique, and the magnetic bubble memory storage, a perspective data storage instrument of computer technology, were developed a year or two after the researchers of the United States. Large numbers of these are in use now and produced abroad, but introduction of the Hungarian achievements is delayed.

It would be a simple and inexpensive matter to blame--again in a generalized manner--the failure to exploit these developments on the lack of interest and narrow vision of the heads of industrial enterprises, though such opinions are frequent in scientific circles. But we are facing a more complicated and multifaceted problem here. The behavior of enterprises expresses economic interests. It is no inadvertence that those enterprises which the competition forces to take on new scientific results--for example, the large pharmaceutical, industrial or agricultural enterprises--are seeking new results which can be taken on and implemented. But this is not yet a general enterprise behavior.

The country, Hungarian society is hungry for science, but some enterprises are not feeling this hunger to a sufficient extent yet.

One of the most important tasks of the technical development policy is to have the tools which indirectly affect technological growth such as the regulation of profit, income, prices and investment, provide better incentives to adapt technological achievements and awaken the receptive readiness of enterprises.

Of course we cannot expect miracles. Basically the country's technological development even in the next decade will play a primarily cooperative role in following in increasing the technological level on the broad scale of industrial production.

I consider the comparison with the era of the great Hungarian inventions to be an unrealistic illusion. These came about at a time characterized by distribution of strength in the world economy and rapid, concentrated growth of industry. But there is a realistic chance for the Hungarian economy to achieve outstanding technological standards and results in a few areas by means of its own research results or by means of rapid further development of knowledge adapted from abroad (or in both ways).

In recent years, the science policy has initiated several steps in the interest of increasing the results of scientific research. Implementation of the National Medium-range Research and Development Plan began in 1981--with no small difficulties. The difficulties are caused primarily by

insufficient preparation and by adherence to old management and financing methods. In spite of this--even though there were some who rang the death knell--implementation of a large part of the programs projected in the plan is proceeding in order, and the backlog of late starts is being gradually made up. Progress made in the areas of energy management and utilization of agricultural byproducts to generate energy stand out. The organizations participating in carrying out programs aimed at the safe operation of nuclear power plants can also report significant achievements. The preparers of the program entitled "Improvement of Grain Production" are reporting concrete results, the production of wheat type candidates and corn hybrids.

In the coming months, the 1981-83 program of reshaping the research institutions will enter a decisive phase--with the formation of the majority of the technological development enterprises. The results and consequences of reshaping can be measured only after a longer time. This is why such statements--also appearing in the press--according to which: "The effect of the decisions was not in proportion with the energy invested..." are not serious. The purpose of the reshaping was to begin a process aimed at increasing the flexibility of a network that had become rigid, and develop organizational forms of interest which help the research basis better conform to the tasks. We must get used to the fact that while the world, the society, the economy and enterprise structures are changing, the research institution's structure cannot remain unchanged, either.

The system of new and uniform training of researchers will be introduced in 1983. We expect this system to provide better organized training and to improve its standard. Minor modifications can also be handled within the system of scientific qualification. The primary item on the agenda is better implementation of requirements and improvement of standards. It may be time to set aside some prejudices here, too: rather than agonizing over the titles of dissertations, the standards must be set high, and candidates should be required to report for their scientific degrees after solving timely and significant research tasks. Setting the standards higher and increasing the requirements on researchers and research institutions does not simply follow from our own decisions. The world's technological, scientific and economic growth sets the standards higher for us. We must pass this hurdle. We have no other choice.

8584
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PROBLEMS OF NATURAL SCIENCE RESEARCH

Budapest VALOSAG in Hungarian No 11, pp 30-37

[Article by Balazs Sarkadi, senior member of the National Institute of Hematology]

[Text] "Increase in creativity is our main national resource which might prepare us for the showdown of the recently begun era.... As opposed to the present, the devaluation of creative intellectual work will be the source of encumbrance during the next decades." (Tibor Vamos)[1]

In Hungary today, scientific research is an activity relatively well appreciated and supported. It can be stated that our researchers are well respected internationally and have gained high esteem domestically from the general public.[2] This is true even though a significant part of the international respect is earned through our scientists who are living and working abroad and even though, in general, the recognition of our domestic researchers is not accompanied by salaries comparable to the wages received by the average skilled worker.

Domestic research activity is burdened by many troubles. Among these, the unresolved problems of researcher training, the mixing of applied and basic research and its unjustified international hierarchy, or the deficiencies of qualification and professional evaluation are increasingly subject to public debate. There is also great danger that the leadership of our country, in the midst of economic difficulties, will cut the allocations for research and, within these, for basic research as a first step. It is in the nature of basic research that the utility of its results can never be calculated ahead. At the same time, it can also be easily seen that, for instance, without basic research in solid state physics, the laser beam, used to operate on tumors, would never have come about; neither would have the transistor radio and modern calculator without semiconductor research, or the use of gene splicing to produce drugs without molecular biology. Similarly, it is also mainly the task of basic researchers to provide the training and advanced training of specialists who are indispensable for advanced teaching and applied research.

It is my conviction that, during the current, relative economic decline, the most important task is to keep intact and advance the infrastructure.

Schools, hospitals, wells, good transportation and telephone network, good health care, a high level of education and advanced scientific research are the only things that enable us to exploit the possibilities of a commencing economic upturn at the right moment. We can best prepare for a "new start" by increasing the ability to adapt and incorporate, by enhancing motility and information exchange. If now, without careful selectivity, we greatly decrease the number of researchers and research sites,[3] and reduce the allotments for basic research, this, together with the many problems and restrictions, will be enough to set back our natural scientific research by years or decades. In my opinion, in our country today, the lack of clarity about the source and precise extent of financial support, thoughtless, bureaucratic system of purchases, the isolation of research sites, and the inhibition of international contacts and information exchange are the greatest hindrance to natural-scientific research activity. In the following, I shall attempt to present these problems and also to make a few proposals for remedy.

1. Purchasing and research--or else, can we know precisely what the future will bring? (Answer: If we would know, why would we need research!)

The purchase of chemicals, materials and instruments is perhaps the most serious difficulty on the calvary of practicing natural scientific research. Today, these purchases require an exact foresight, several years ahead, which is a priori impossible because of the nature of research activity.

Let us begin with the purchase of chemicals, a field presenting the most spectacular contradictions. It is a basic requirement for the work of those engaged in the fields of chemistry, physics and, particularly, biology and medicine, that the new chemicals and medicines, which have a well-defined influence on certain chemical and life processes, must be available as fast as possible. In Hungary, many basic chemicals can be ordered from domestic factories and distributors. The quality and packaging of domestic chemicals can often be criticized. Even in the case of stocked materials, their transportation may require weeks and months. Nevertheless, these products are more-or-less available. The situation is quite different for chemicals which can only be purchased from abroad, mostly from capitalist countries.

On the capitalist market, the demand for chemicals, which has increased enormously all over the world, is satisfied within days--or weeks at the most--after their order by the appropriate companies on the basis of their catalogues which appear annually or semiannually. But we cannot take advantage of this very important speed. Although some domestic institutions and laboratories already have more-or-less well defined funds for import chemicals and the catalogues are also available everywhere, ordering still proceeds as follows: Import chemicals can be requisitioned once, at best three or four times a year depending on the institution. The requisition, which must often be submitted half a year before the target year, must include a detailed description of the wanted chemical, the catalogue (order) number of the manufacturer and the price in foreign currency or forint. However, such an order does not go to the appropriate foreign company but starts on its endless road between officials and the chemical enterprises. They review, evaluate and occasionally modify the order without consulting the one who had

placed it. Finally, after an average of one to two years of processing time, the ordered preparation arrives at an incalculable moment. In a lucky case, the ordering researcher still remembers why he had requested the material at the time. In a worse case, the chemical is already completely superfluous, occasionally, the one who ordered it no longer works at the institution, his project was discontinued, his successor cannot even remember why he would have needed the particular chemical. Thus, the ever growing number of chemical cabinets and ice boxes of every domestic laboratory are filled with materials bought for hundreds of thousands of forints worth of foreign currency and with much struggle. In time, these will be ruined, decomposed or thrown into the garbage. The only solution is a steady, non-official "exchange" among the institutions and laboratories which may bring quick help in lucky cases. It is very important to stress that the endless delays of chemical purchases is not planned and does not represent realistic controls: If someone is sufficiently patient in ordering a substance, he will finally receive it, in general. It is another question whether it will still be good for something!

This is particularly valid for radioactive isotope purchases. Isotope preparations have to be ordered a year ahead even if their half life is merely a few hours. Research work cannot be planned realistically so far ahead. Thus, masses of decomposed, at times unopened packages of radioactive materials must be discarded. In one case, on Friday afternoon, a desperate janitor has called back by phone one of the researchers to accept the just-arrived isotope with a half life of a few hours. It is another question what the researcher could have done with it then.... It was also repeatedly found that this does not depend on a given-usually quite helpful official in charge. It is the structure of the system itself, the rotting beams of which pose the obstacles and put many slivers under the nails of researchers.

The purchase of auxiliary tools, laboratory equipment, small instruments or accessories is not a bit simpler than that of chemicals. Here also, all types of orders must be submitted years ahead. At most institutions, a campaign is started at a certain time of the year to order glassware, low cost tools and instruments. At such time everyone puts on his magic glasses, decides what he could possibly need a year or two from then, and requests all the materials and tools that the funds will cover. At least, there will be goods for exchange. Besides: if we order less now, they may decrease our funds for next year! It is also not rare that a certain material or tool, bought for foreign currency but originating from home or from a socialist country, arrives after 4-5 years of waiting. Many laboratories have valuable instruments, purchases for tens of thousands of dollars, idle because of lack of parts: ultracentrifuges with cracked but not replaced tubes, recording instruments without paper or even without indigo tape. A considerable part of a researcher's life is spent with running after and begging for such missing parts. On the other side of the same problem, most domestic laboratories have their cabinets filled to the brim with useless glassware, superfluous tools and materials accumulated during many decades of an incalculable purchasing process. In professional terms: our stocks are filled with superfluous materials obtained through overpurchases in an economy of shortages.

Neither is the path of purchasing valuable installations and instruments more glorious. The process begins with the researcher (group) receiving the happy news that the purchase money was approved after a few months, years or decades of longing and petitioning. Through the appropriate "Impex," the institute requests a so-called pro forma price quotation from the manufacturing company which, in general, does arrive within a few weeks or months. Prepared on this basis, the order will then start on its path of several months of delays (approval? another endorsement? paper shuffling?). When it returns, it turns out that the price of the installation was raised meanwhile and the original sum is no longer enough to buy it. Consequently, additional credit is sought-another pro forma request-another approval (occasionally another price increase and then all the rest from the start). Even after an approved, accepted and discussed order, it often takes half to one year for the order to arrive. It is often missing or having the wrong attachments: in the course of all that paper shuffling, this or that was left out from the order or even attachments of unknown purpose and source were put on the final order form (which can no longer be checked by the researcher). If the instrument is already obsolete at the time of arrival, or if its original purchaser is working somewhere else in the country, on some other project, the institute is still enriched by a beautiful "totem" worth a hundred thousand or a million forints. Unfortunately, most Western companies are well acquainted with the potholes of our ordering system and, sometimes, take great advantage of it. They will often unload on us outmoded, almost useless machines and parts or some which had proven superfluous long before. In the absence of suitable contact with the seller, the researcher cannot decide what could be subtracted from the package shown in the price offer while the usually non-knowledgable foreign trade official is not interested in getting maximal performance for minimal expenditure.

Several possibilities present themselves to decrease the purchasing problem. The first and most important step is to define more precisely and to liberate the purchasing funds of the institutions and laboratories for chemicals, materials and tools. It should also be spelled out how much of the funds can be used for foreign currency purchases. (Currently, this largely depends on the actual foreign currency situation of the foreign trade companies.) After this, use of the funds should be left to the discretion of the one who orders. Thereby both purposeful purchase and its control would become possible. To achieve this, it would be absolutely necessary, of course, that the sum, received on time, could be used even for daily necessities--at least 20-30 percent of the funds should be left out from the allotment for annual orders of high priced basic materials. It is also important to have the quick orders processed by flexible enterprises with foreign trade rights and practices, which would also be willing to deal with small entries without wasting time. The argument that large orders are cheaper and simpler is basically false in the field of research. We may get goods for less but they will only be "utilized" by waste cans! A basic requirement of effective research is to discontinue orders in the one to several years range. Large institutions--universities, research institute colonies--should be provided with common, well stocked "warehouses" with rapid restocking capabilities where the researchers could immediately get the needed chemicals, supplements, small appliances or tools and could charge them to their allocations. As recommended recently

in an article in MAGYAR TUDOMANY:[4] "A small information center free of red tape but fully equipped on a voluntary basis with the appropriate data" which would facilitate the exchange of stocks accumulated in the laboratories, would also be very much needed. Whoever worked at a large university in the U.S. or in Western Europe knows well that central stockrooms make most of the laboratory stocks unnecessary, they serve the researchers on a daily basis and facilitate the exchange of unnecessary equipment. Local, well equipped workshops employing trained technicians and engineers would play an enormous role in providing instruments and tools requiring foreign currency. They could produce these tools much cheaper, faster and according to the individual needs. Regretfully, very few places have them.

In purchasing radioactive isotopes, it would be vitally important that only the expected demands for the year would have to be submitted while individual products could be purchased any time taking into consideration the manufacturing data. The waste incurred by the disposal of decomposed isotopes consumes much greater sums than the organization of flexible production would cost. Of course, this should also be felt by the producers and distributors.

In purchasing large instruments and installations, the specialized knowledge of the researchers should receive a much greater role than at present. If the discussions have truly specialized character, if the rapid, rational use of the available sums is insured, that is, if it is in the researcher's interest to buy more and better quality for the given sum, then the utility of the expenditures will be enormously increased.

Most importantly, these changes can be successful only if carried out jointly and simultaneously. For instance, insuring the funds alone, without the appropriate purchasing possibilities, is worthless. I honestly fear that, on the basis of this description, someone will say: see, researchers get so much money that all of their stocks are full with chemicals and materials--we can safely decrease the allotments and achieve suitable distribution with some compulsory cataloguing system! On the contrary, effective research is possible only if the number of bureaucratic regulations decreases and the flexible use of funds, true savings, are made possible by the changes mentioned above.

2. "Interactions represent the essence of science"--Francis D. Crick[5]

This observation is even more true for research in such small countries as Hungary. As confirmed through the persuasive argument by Professor Straub:[6] "Hungarian science can certainly provide less than one hundredth of the new results which are also important to us.... But science can have an important role determining how and how rapidly domestic application follows the global level." In this same article, the story of the discovery of vitamin C is used by the author as a basic example of the interdisciplinary and international character of research. The idea of Albert Szent-Gyorgyi in Szeged was formed into an epoch making discovery worthy of the Nobel prize through the work of a U.S. physiologist, and of Hungarian and English organic chemist colleagues invited there. Therefore, one important consideration is that scientific results, arrived at world-wide, can only be applied at home if

Hungarian scientists have the best possible information. The other consideration is that that certain one percent contribution in the area of basic discoveries can be realized if we react in time and succeed in selecting those relatively few possible "breakthrough points" where we can have any hope at all to overtake the world. And this is not at all just competition for its own sake: "In utilizing the new scientific discoveries, the society where the result was born has, of course, an advantage." (And Professor Straub adds here: "provided that the chain of innovation functions well!")[5] The international acknowledgment of Hungarian science is earned clearly through the new scientific results and--to complete the circle--this enables us to discover one or another new breakthrough point through the interactions developed in this manner.

In natural scientific research today, the main sources of information gathering and of interdisciplinary or international interactions are the international journals and books, congresses, symposia, and the brief or prolonged visits as visiting researchers. Let us see how this system works and what are its most urgent problems today, in Hungary.

The most basic mode of inquiry for the researchers is the regular reading of international journals. The "ranking" of these journals is influenced by several factors. At any rate, this ranking as a decisive influence on the extent to which the published papers are read and acknowledged. One of its most important measures is how the articles are quoted: that is, to what extent a given paper is referred to as source material in subsequent publications in the field. The extent of being referred to and the "ranking" of the references are perhaps one of the most widely accepted possibilities of evaluating scientific achievement today.[7] The better international journals are, naturally, very selective: although the effect of individual connections and some "science political" maneuverings often comes to the fore also here, professional review is the strongest consideration. A paper appearing in some of the highly regarded and well read journals is a great success and acknowledgment of scientific achievement.

Depending on the character of the journals, the time between receipt and publication of a paper is 3-12 months. Thus, the already published articles (by the time they reach us) cannot be considered as current work in progress but rather as the reporting of work already completed or at least representing a definite level of achievement. It is a general, international practice that the researcher requests reprints of the articles within his sphere of interest. The journals--in part free and in part for a fee--provide a few hundred reprints which the author distributes among interested colleagues. The well working system of reprints is useful both to the author and to the reader. The author uses it to advance himself while the reader receives a source relatively fast which is always available and can be browsed through even in the evening at home.

What is the situation in Hungary with respect to journal articles? It is a good thing today, as opposed to the practices of the 1950's, that Hungarian researchers (with the approval of the institute head) can submit their papers

without limitation to any international journal and that some domestic journals also have high international standing. It is excellent that today, the information service of the Hungarian Academy of Sciences already provides services for keeping up with topics, examining quotations, etc. The importance of these can be fully understood only if we know that certain topics can yield from 5-10 to as much as 200-300 journal publications per week! It is another question whether such a massive flood of information can be handled at all but it can at least be attempted with such help. But let us now look at the problems!

Because of the relatively high subscription price of international journals (about $50-$300 per year), understandably, a given institute or university library can order only a few journals belonging to the most limited circle of professional interests. Regrettably, the arrival of even these few journals is rather troublesome. Often (and almost always because of delays in domestic handling), they are late or are stored unopened in some store room. Although this is a glaring example, it did happen that some international journals, extremely important in the field of biochemistry, arrived to every Hungarian library with more than a half year delay! Adequate Xerox capacity and the formation of large central libraries, and also the furnishing of reprint requests would be the solution in this area.

In research, certain publications often serve as a "biblical" background to further work. While unbounded journals (correctly) cannot be checked out from most libraries, the copied articles or reprints can be freely used by everyone. Most frequently, researchers have only the late evening hours free to read the professional literature--but this can only be exploited if the article is also available. Regrettably, the hindrances are greatest precisely in this area. Xerox or other copy machines are available at increasingly more locations but their use is greatly limited in general. In worse cases, copying is completely unavailable or it takes so long (3-4 weeks for an article) or it is so costly (4-5 forints/page, paid by the receiver) that such a demand becomes completely hopeless.

Instead of the current, poorly catalogued, scarcely available (mostly open only during daytime), scattered libraries, the universities of Budapest instructing tens of thousands of students have thoroughly earned a large, modern, central library. This should have computerized subject and author catalogues, should be open also late at night, should have adequate reading rooms and open shelved book arrangement, should have copy machines and should be useful both in teaching and research. Such an investment would be amply returned through lowering the enormous foreign currency costs of book and journal purchases (currently, instead of 1-2 good libraries, 20-30 hardly useable ones purchase the same material), and through the rapid availability of useful information.

The storms are also increasing in the area of reprint requests. Since mid 1981, there have been regulations at several universities according to which reprint requests or mailings must be paid for by the researchers themselves. khis sum, although a small item in the research budget, is a serious drain on the low research salaries. Perhaps most hurtful is the loss of a possibility to distribute ones own work. Domestic scientists can under no circumstances

pay "from their pocket" for the reprint fees charged by the journals and for the massive mailing costs. Thus, they are deprived of the possibility to sneak the account of their newest results directly on the desk or even into the bed of their colleagues. The entire regulation is a clear example of negative reinforcement: do not write or read, thus preserving both your "poverty of spirit" and your salary! The limitations associated with copying, and reprinted distribution and request are merely sham economies, at the same time resulting in a hurtful slowdown of information flow.

Another main and equally important form of information gathering by researchers is based on personal connections and meetings. The domestic and international symposia, congresses, work shops, scholarships and research exchanges form the basis of a rapid and frank information flow. The tense "glory" of congressional lectures is one of the strongest stimulations to strive for something new on the international level, for outstanding scientific results. The importance or insignificance of ones own work can only be truly evaluated in this manner. As opposed to the data in journal articles with their delay of half to one year, we can also become acquainted with work currently in progress. These personal contacts provide the real possibilities to detect the "breakthrough points." In professional devates, it rapidly becomes evident who can be really trusted (because, however surprising, a large part of the professional papers cannot be repeated, they are the description of misinterpreted experiments conducted less than professionally). Thus, we can get the feel of the importance of worthlessness of new, just starting trends, in a few words we can get answers to questions which have bothered us for months. In a few words we can get answers to questions which have bothered us for months. If we read the history of some great discoveries, it often begins somewhat like this: "I got to know Bob on the beach of the Pacific Ocean where both of us fled from one of the lectures of the congress. We sketched our newest experimental results in the sand for each other and then it became clear that...." Bohr, Pauli, Einstein and Heisenberg have formulated the groundwork of modern physics in the course of mutual visits and cooperation, friendly discussions and dinners, and mutual tumults. The double helix model of DNA was first constructed through the travels of a young biochemist (J. D. Watson) by "picking up" the partial results of the real experts.[8] The expansion of individual research connections is the only way to develop flexible and significant research in our country as well. However, the truth is that, although there are hardly any theoretical limits to congress participation, domestic or foreign travels, the practical difficulties often discourage the spirit to be venturesome.

Without being assured of the expenses for travels, information services, etc., our work is often in vain--we discover electricity just as the next door neighbor gets it installed! The expenses for international congresses, currently amounting to many hundreds of dollars, are indeed difficult to procure. However, while earlier it was possible for a research institute or university to use its income from extra work or from some practical activity for travel by its researchers, this was discontinued in most places. With the exception of some pharmaceutical works or more prosperous industrial research institutes, the researchers' travel can only be financed by themselves or by those

who have invited him to congresses and meetings abroad (but in many institutions also within the country).

In spite of all this, I am convinced that lack of money is not the real hindrance--other limitations present much greater obstacles. For instance, for foreign travel, a permission is needed from the research institution, from its direct and higher supervisors, often from the National Scholarship Council. Only after having gotten all these, can one start to get the service passpord (window) and the necessary visa, and finally, to make the concrete travel preparations. After the detailed forms, filled out again and again, and the supplemental explanatory and supportive materials have been submitted, processing takes an average of 2-6 months. We might feel that all this control and rechecking is justified when travel is financed by the higher authorities or some state scholarship. At the same time, it is unjustified that a researcher with scientific qualifications at home should have to go through the same procedure for foreign travel, all the expense of which is financed by himself or by the inviting institution. Much controversy surrounds our scientific qualification system, but the greatest feat of arms would be if it would truly represent some scientific qualification. Whoever is accepted to the Academy of Sciences as a candidate or doctor, should justly count on help from the Academy to form and expand connections. It would be important that, at least those scientists who have qualifications, when they do not ask for money for their trip and they have the approval of their own institution, should receive, without further processing, permission from the Academy to apply for a service passport or passport window. In the present situation, it is not merely the repeated filling out of forms, curriculum vitae, scientific project plans, professional recommendations, etc., that deter people from planning a trip but mainly the time factor. For instance, because a scholarship abroad cannot be applied for without previous permission from the National Scholarship Council, but it often takes 2-3 months before the permission arrives, to obtain a scholarship with a dealine is just about impossible. Many organizers of congresses, international scientific meeting and professional training sessions can advise only a few months or weeks before the trip whether they were successful in inviting a Hungarian colleague and covering his costs. Often, by the time the laboriously prepared invitation arrives, it is already in vain. It is a painful defeat to the researcher and to our entire science-organization system that there no longer is enough time to complete the formalities. A service passport window which can be obtained rapidly and simply would contribute much to the increased openness of Hungarian researchers toward the world.

To support the acceptance of foreign research positions and collaborations would also be in the primary interest of domestic science. Our scientists could be trained in the leading professional institutes and laboratories almost without expense. For U.S. scientists, the employing institution must grant so-called "sabbatical years"; that is, after every six years of research, they are entitled to a half or one year of a salaried, freely selected study trip. At such times, the researcher can go any where in the world to get acquainted with new methods, thoughts and trends. Let us not believe that this is of some social significance in the pragmatic U.S. research! It is very well calculated to rekindle the urge for research, to collect new ideas

and to stimulate influences which would only be to the advantage to Hungarian researchers as well.

In Summary: In natural scientific research it is extremely important that a steady backing be provided by a simple, rapid and flexible supply system. This could be best achieved if, alongside with adequate professional controls, trust in the researchers would be increased to the extent that, within the given financial situation, they would be able to order material, tools and instruments free from the bureaucratic regulatory system, and would receive substantial heop in developing substantial international contacts.

FOOTNOTES

1. Vamos, Tibor: Our Country and Technological Advancement MAGYAR TUDOMANY 88, 1981, pp 333-350.

2. See: D. DeSolla Price: Small Science-Great Science; Academic Press, Budapest 1979; NATURE 292, 1981 p 665; TUDOMANY ES TARSADALOM Interview with Pal Lenard, executive secretary of the Hungarian Academy of Sciences; NEPSZABADSAG 16 Aug 1981.

3. According to a 1981 regulation, the number of researchers in academic research institutes may be considerably decreased. This decrease is valis everywhere. For instance: it also refers to the very promising Biology Center in Szeged which was built and started just a few years ago at a cost of many millions of dollars and forints with help from the UN-UNDP foundation. In addition, the decrease in numbers within a few years must be done in such a manner that, as a function of how fast and how many researchers are let go, their salary can be divided among those "remaining." (Compare with the novel by F. Durrenmatt: "Visit by the Old Lady"!)

4. Schlammadinger, Jozsef: In the Interest of a Better Research Information System, MAGYAR TUDOMANY 88, 1981 pp 700-800; and related articles by Pal Peto Gabor in the Sep 1981 issues of NEPSZABADSAG.

5. Garvey, W. D.: Communication: The Essence of Science. Pergamon Press, Oxford 1979.

6. Straub, F. Bruno: What Can Society Expect From Domestic Scientific Research? MAGYAR TUDOMANY 88, 1981 pp 721-726.

7. Bujdoso, Erno and Braun, Tibor: The Role of Publication and Communication in Modern Scientific Research MAGYAR TUDOMANY 88, 1981, pp 351-357.

8. Watson, J. D.: The Double Helix, Gondolat Publ. Budapest 1970.

2473
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COMMUNICATIONS FACTORY TO PRODUCE ELECTRONIC MAIN EXCHANGES

Budapest NEPSZAVA in Hungarian 30 Dec 82 p 4

[Article by Miklos Monus: "Electronic Exchange"]

[Text] The Hungarian manufacturer of telephone main exchanges, the Communications Enterprise of the BHG [Beloiannisz Telecommunications Factory], produced interesting and important news in the last days of the old year. The BHG plans to convert production from crossbar-type mechanisms to electronic main exchanges. As a result, Hungary may shortly make up her 10-15 year lag in comparison with developed countries' communications networks, at least in the exchanges indispensible to the interconnection of telephone systems.

What is the difference between the mo-t advanced mechanical exchange, the crossbar-type, and the electronic telephone main exchange? In order to understand the difference, let us compare a modern mechanical and an electronic receiver. In its finished state, the mechanical installation is the size of a household matchbox, while the electronic one is about ten times smaller. The mechanical type contains much material, and the electronic--to use an imprecise, but relevant term--contains much science. The former requires systematic maintenance, while it does not have to be touched after production. This also applies to installed telephone exchanges.

Chosen from Five Offers

Compared to the mechanical exchange, the electronic one requires ten times less space. The crossbar exchanges are connected by either very wide and often leaky or narrower, hard-to-install and expensive coaxial cables. The electronic main exchanges are connected by the so-called PCM connecting network, in which each individual connection is 20-30 percent less expensive than the previous type.

BHG announced last year that it was interested in buying a license for the manufacture of electronic main exchanges. Five offers were received at the enterprises. Which offer is to be accepted will be decided in conferences during the new year.

"Our most important stipulation," Managing Director Frigyes Berecz informs us, "is that we should be able to repurchase the convertible foreign exchange

"necessary for buying the license through sales in non-ruble based countries. In other words, production must not harm the economy's foreign exchanges balance in the short run, and must not decrease the country's currency reserves."

Will there be foreign markets for the Hungarian products? "Certain terms that apply to the world economy, such as reducing production, limiting capacity and investment shortage, do not apply to the telephone industry. The number of telephones worldwide increases by 6-7 percent each year, and in 1990 twice as many will be in operation as in 1980. Today, and even more in the future, everyone wants to insure the connection of these lines through electronic main exchanges. We are not afraid of not receiving orders.

From Domestic Parts

The electronic main exchanges are assembled from electronic parts and mechanisms. Domestic enterprises will be responsible for planning their production. Among these are the newly formed Microelectronic Enterprise, and among the older members of the field, Remix, Kontakta, and others.

"We will assemble the first parts of the main exchange in 1985," says the managing director. "Two-thirds of the necessary parts will be shipped by the originator of the license. Meanwhile, our domestic electronic enterprises will prepare for the production of the necessary integrated circuits and other parts. After the license has been taken over, the overwhelming majority of the parts will be supplied domestically whereas the portion furnished by non-ruble accounting countries will be no more than 10-15 percent."

Are these merely expectations? "No," declares the managing director. "These are the plan recommendations that were compared and approved by the higher directing authorities and the directors of the affected enterprises."

For the production of the new article, skilled workers are necessary. About 500 engineers, technicians, and workers in the BHG can now say of themselves that they are experienced in the development, assembly, and measurement of electronic devices. The most skilled work in a unit merely called the "Wagner-shop," named after the director, Gyorgy Wagner, according to Lajos Pato, chief engineer of the development department.

Regardless of their capacities, enough electronic sub-exchanges have been produced for many years to equip twenty to six thousand [as published] secondary stations.

"There are no excuses in electronics," concludes the plant director. "It only works if perfect parts are assembled, unbelievably precisely, with complete attention to technological discipline, into devices, then into complete installations. Everyone here at the enterprise must understand this."

What Will Be the Foremost Product?

The enterprise's strongest and foremost product is still the family of electronic sub-exchanges, and from now on the new main exchanges will take its place.

Is this a promise for the fairly neglected Hungarian telephone system? Can we expect that as a result of the domestic production of electronics main exchanges, shortly everyone who requests a telephone will be able to get one?

Countries industrialized similarly to our own allocate 2 percent of their national income to the development of their communications networks; less developed countries devote even more. On the average of the past 30 years--thus not in the present low-investment period--we sacrificed 1 to 1.5 percent. There are twice as many telephones per person in GDR and Czechoslovakia as in Hungary.

Two-thirds of the BHG's present crossbar-type products are slated for export; one-third remain within our borders. For the enterprise's new products to be a promise to us who wish to make calls, that former ratio must also be modified.

9890
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COMPUTER DEVELOPMENT, PRODUCTION, SHORTCOMINGS OUTLINED

Reduced Production, Problems

Warsaw KIERUNKI in Polish 28 Nov 82 p 12

[Interview with Andrzej Musielak, Executive Director of the ELWRO Computer Systems, Automation, and Measurement Instrumentation Center, by unidentified KIERUNKI reporters; date and place not given]

[Text] [Question] Mr Director, as head of Poland's only computer factory, are you not irritated by the fact that most of the equipment you produce is being used improperly or not being used at all?

[Answer] Let's get our facts straight first. ELWRO is not the only computer manufacturer in Poland. In Wroclaw we produce only the medium-sized main frames ODRA and RYAD. Small computers are produced by the Warsaw Computer Systems Manufacturing Plant and the Katowice Minicomputers Center. Now, getting back to your question, a computer is sort of like a piano. For someone who does not know how to play this instrument, it's going to be nothing but a useless piece of furniture.

[Question] So, do you know of any cases where computers are being used properly?

[Answer] The computer center operated by the Citizens Militia Voivodship Command in Wroclaw, under the direction of Mieczyslaw Hryniewiecki, is a model operation; here I am talking about the technical aspects of the center's operation, since I'm not going to go into what kinds of records or data they use this computer to process. The upshot is that they are not letting this computer go to waste, and even though they are working on three shifts, the users at this center are satisfied.

[Question] But you are not answering our question. We are not interested in the technical aspects of data processing science--although that is important too--but rather in the benefits (or lack thereof) derived from computer system applications. Do you agree with the view that too many computers are not being used to their full capacity to Poland? That data processing science is not being applied on a broad enough scale, that we are not getting anything out of the application of computer systems, that, furthermore, the application of computer systems is a source of additional

costs, raises the level of employment, promotes increased tensions and confusion in the workplace...as proof of which we have seen how computers are being gotten rid of by such industrial giants as "Pollena," which has given up on the application of computer technology in its operations?

[Answer] If a computer is not being used efficiently, then this, of course, gives rise to a number of adverse consequences. But you should also remember that increased speed, regardless of whether we are talking about moving things from point A to point B or also the procession of information, has to cost money. The faster you do it, the more expensive it becomes. Data processing science is a tool for the rapid procession of information, nothing more...

[Question] To what end?

[Answer] In order to be able to make rational decisions.

[Question] But everywhere we turn we see irrational decisions being made, and these decisions very often have very little in common with the information which went into them.

[Answer] The computer does not usurp man's role in the decision making process; after all, the basic rule of data processing science still applies--garbage in, garbage out. And we, as manufacturers, have no say in how somebody is going to use our ODRA computers. It is much the same thing as with pianos, that is, some people play Chopin, and other people just bang on the keys...This is none of the manufacturer's business.

[Question] But if they are all just banging on the keys, then the manufacturer ought to stop and think about this...

[Answer] But we are not at all required to think in these terms. This is entirely the business of the users, since they are the ones who shelled out millions for this hardware and they are responsible for it.

[Question] Does your firm also design software packages for the ODRA and RYAD computers?

[Answer] Only the software for the operation of the machine-operating system dialogue. We do not write full "musical scores." Nor do we design user applications software....

[Question] Mr Director, if it is not a secret, could you tell us something about your output volume?

[Answer] Our output is not very high right now. This year we will turn out seven RYAD computers and eight ODRA computers. There were years in which we were producing around 100 machines per annum.

[Question] Why so little now?

[Answer] Our output has not declined at all in terms of earnings....

[Question] Did you raise your prices?

[Answer] No. We have even lowered our prices. We are producing high-configuration machines and others...As a result of the reforms, the purchasing power of many of our customers has declined....

[Question] Since a computer, in your opinion, is supposed to produce profits, is it not still an economically desirable capital investment regardless of the cost?

[Answer] There used to be a time, or rather a style of doing things, when decisions on the purchase of a computer were made at the national level. There was the national plan distribution list, according to which plant X or plant Y would get a computer and would not be held accountable for such a decision. This may be the original of the disparity which you gentlemen were asking about at the start of this interview. Nowadays, the plant director, the workers, and the self-management board think long and hard about what to buy; about what is more important--work shoes for employees or a digital computer. It more and more often happens now that there is not enough money left to purchase the latter.

[Question] But if the computer "delivers" (theoretically speaking) the plant the funds needed to buy work shoes, then it pays for itself, does it not?

[Answer] Thanks to the institutional machinery of the economic reform, we are finally going to have a more rational and efficient system of industrial purchasing. And this, after all, is what you were interested in in your initial questions. There are many enterprises which do not have to buy a computer in order to benefit from data processing. There are the ZETO [Main Electronic Computer Equipment Center], industry-wide, and other computer centers which can provide data processing services on contract. But when it comes to the application of computers to the process of business enterprise management--a subject in which you also expressed an interest--, then the benefits are not too quick in coming or too clearly apparent. This is why, in a situation where you have to pay out some 10 million zlotys, and out of your own pocket at that, for a computer, many enterprises are giving up on owning their own computers. However, I believe that there are many "public service" industries where computers are simply indispensable, for example, banks, State Savings Banks, railroads, and so on. Namely, service industries which are much neglected and which would benefit greatly from the help of computers. The process of computerization has yet to get started in these areas.

[Question] We have heard that the technical preconditions for this do not exist, if only in terms of the shortage of remote data transmission terminals. Is this true?

[Answer] At this point in time we, of course, cannot afford to computerize all of these areas, but we have to make some choices, select one of these application areas, and bring the computer hardware on line. For a long time now we have been working together with the National Bank of Poland on a comprehensive design of a data processing system involving the use of computers. This program is technically feasible and necessary. This is what one hears, first and foremost, from bank customers who periodically receive account statements, cost breakdown studies, and almost immediate and error-free financial statements. These kinds of applications have one more advantage. Namely, the benefits of computerization will be tangible and immediately recognizable, which means that people will quit talking about data processing as if it were some kind of arcane science for the elite, for the high priests of computer science. This line of thinking has caused many users to be frightened by computers. Data processing services and computer applications ought to be made accessible to the lowest levels of the management hierarchy. In this way data processing science will produce practical benefits. As for centralized systems, national computer systems, "infostrady" [translation of acronym unknown], and so on and so forth, let these systems remain under the jurisdiction of GUS [Main Office for Statistics].

[Question] What kinds of barriers are really standing in the way of these kinds of user-oriented, pragmatic applications?

[Answer] First and foremost, we have been and still are faced with a shortage of specialized terminal hardware. Right now we are working on designs for these kinds of terminals. Here I am talking about specialized bank terminal units which are directly linked with digital computers. In the future we will be thinking about what kinds of terminal systems should be used for rail transportation services, postal services, and so on. As far as the installation of a railroad seat reservation system is concerned, we have already finished the hardware-related aspects of this project. We have the visual display units, we are producing a teletransmission processor for remote data transmission, and we have a computer capable of handling this kind of work--the RYAD-32. The only work that remains to be done is to prepare an organizational system and have the user design a software package.

[Question] You are turning out barely 15 computers a year, so you are probably not having any problems selling them. Nor are there any problems when it comes to marketing, advertising, promotion, and so on. Are you worried at all about the progress of computerization?

[Answer] Yes. I am concerned about the progress of computerization in a direction which would at the same time serve as an encouragement to others, in a direction whose benefits would give other users an incentive to find applications for data processing. For us the National Bank of Poland is just the right kind of client in this regard. It would be too costly to pursue this matter on a broad front.

[Question] You have produced 15 computers, or one-seventh of what you produced a year ago. That is not enough to be able to think about export sales. In the meantime we have learned that ELWRO has increased its foreign sales of computer hardware.

[Answer] You gentlemen are preoccupied with main frames, the actual computer. It is true that we are not producing as many of these as we used to. However, we have stepped up the production of data teletransmission processors which make it possible for a given workplace to "converse" with a computer. This kind of processor is a separate computer in its own right. We are producing more than 60 of these systems. These devices make it possible for a system to operate along much the same lines as the system which is already in service with the Polish national airline LOT and is used for making seat reservations. We have already gained some experience in industrial settings, including, inter alia, our own plant where data processing services have "trickled" all the way down to the desks of accountants, warehouse managers, designers, and so on. And we could not imagine surviving without these display units, without this system. Using this data processing system , the process of switching over from "old" to "new" prices took 2 weeks. If we had to rely on the "finger-counting" method of doing things, I do not know if we could have accomplished this in a year.

[Question] Even so, we are convinced that most of our white-collar workers regard the computer as an infernal device which is to be feared.

[Answer] I once attended an exhibition of computer hardware in England. There I saw teenagers who without the slightest hesitation proceeded to operate some of the equipment on display with great skill. In Poland too we have to break down psychological barriers and promote public education about data processing. Data processing classes are being offered in secondary schools, but, I ask you, in how many of these schools do students have a chance to work with a real display unit terminal? To be sure, they have a thorough grasp of Boolean algebra, but they are not going to be in a position to use the most elementary kind of terminal equipment. Popular ignorance is a stumbling block. People are embarassed to ask: "How does this work?" or "What is this used for?" They are afraid they will be laughed at. In any event, the same holds true for university graduates. They spend two years studying data processing, they know all the definitions, but then they are not able to operate a simple keyboard terminal. These kinds of "computer specialists" are the enemies of computerization.

[Question] The reasons for this state of affairs are many. First of all, we do not have any display unit terminals or even small, low-cost computers. Our computer hardware is around 100 times more expensive that western counterparts!

[Answer] Exactly. We are technologically backward, especially when it comes to the manufacture of microprocessors and microelectronic components in general. But I think that a profitable and high-quality microprocessor industry will emerge in this country. CEMI [Semiconductor Scientific Research Center] in Warsaw is gearing up for this. At the same time we need to get moving on the production of peripheral hardware, modules, keyboards, small printers, tape recorders, and so on. But this is a question of 5 to 6 years.

[Question] We used to be a world leader in the production of electronic components. We started turning out the first, exclusively Polish transistors 3 or 4 years after the Americans. Why is it that we are now bringing up the rear in the field of advanced electronics?

[Answer] I personally believe that we moved ahead on too broad a front by developing those kinds of industries which we can ill afford. Take, as the first of a whole host of examples, the construction machinery industry. If we are a net importer of iron ore, does it really make any sense at all for us to launch a crash program to start fabricating materials-intensive equipment out of materials which are in scarce supply in this country? As if in stubborn defiance of all common sense, we have been pursuing a course of building up energy- and materials-intensive industries, with the much touted shipbuilding industry at the head of the list. In a situation where we are forced to contend with a scarcity of raw materials we should be focusing our attention on the electronics industry, which truly does not require large amounts of raw materials. The simultaneous promotion of the growth of all industrial sectors, as was the case during the 1970s, is one of the reasons why we would up in a recession.

[Question] Is it true that in those days the computer industry was not able to take the initiative in giving a demonstration of its own efficiency and profitability, to prove to the decisionmakers that it should be given a higher priority than other industries?

[Answer] Was the institutional machinery in place in those days that would have made it possible for us to compete in this way?

[Question] Is it in place now?

[Answer] I personally believe that it is. The economic reform is supposed to create this kind of institutional machinery. That is, the kind of institutional machinery which will give priority to improved, more cost-effective, and more efficient management. In other words, the electronics industry is going to stand its ground. In any event, this is already apparent in the case of our own enterprise. There are capital projects in this enterprise that were started as far back as 1972. It was not possible to carry on with these capital projects due to a lack of appropriations. We have now succeeded in earning the money we need for these projects, and we can spend it however we wish.

[Question] So, how is it that the electronics industry can make a profit, since domestically manufactured subassemblies are so costly? All western firms produce the same subassemblies at a lower cost, so what is going to happen to our export sales?

[Answer] What we are going to do is to sell our skills, our ideas, and our labor. And for that matter we are already engaged in coproduction programs with several firms. The return on investment generated by these export sales is very high. For example, we are able to purchase one dollar's worth of goods for an investment of not quite 60 zlotys. Thus, we are

exporting teletransmission cables for the IBM corporation, and we are exporting the aforementioned teletransmission processors to socialist countries. Several of our experts in this field are working on the installation of western industrial process control systems throughout the world, ranging from Costa Rica to Australia. Provided that the government will continue to maintain its resolve in pursuing the objectives of the economic reform, these kinds of programs--and hence the growth of the electronics industry in general and the computer industry in particular--will be expanded.

[Question] Could you perhaps take a stab at giving us your vision of where your firm will be in, say, 10 years?

[Answer] I cannot talk openly about things that would amount to a disclosure of our strategy for growth and expansion.

[Question] You could easily do so, since you are not faced with any competition on the domestic market, at least as far as computers are concerned.

[Answer] Oh, come on now, I do not have to produce any computers at all. We are going to produce only those things that can be sold on the domestic market. Our product line also includes measurement instrumentation, automation equipment, electronic calculators....

[Question] Except these calculators are of inferior quality and very expensive.

[Answer] I wouldn't put it that way. The quality of our "Jacek" calculators is not inferior to that of western-made calculators, and the price, on the other hand, notwithstanding the rising costs of raw materials, wages, transportation, and so on, has been cut almost in half. It goes without saying that we cannot put ourselves in the same league with the U. S. or Japan. What is hindering the growth of our electronics industry is the sorry state of our raw materials and subassemblies infrastructure, whereas an underlying cause of the whole problem is the underdevelopment of the basic research infrastructure, the low level of spending on research and development, and the substandard efficiency of this research and development effort. If the end product, an electronics industry product, is supposed to have a high quality rating and be competitive, then we should reinforce all of the links in this chain. So far we have spent most of our time looking at the manpower angle of all this and, as a result, we have been most concerned about the producer of the finished product. I myself have doubts as to whether we are going to make it in such a specialized area, since, even though we have everything we need to do so, we cannot manage to produce ordinary baby food comparable to the MILUPA brand. We have the raw materials, the factories, the Mother and Child Institute, and whatever, and we are still producing junk, since the BEBIKO brand of baby food cannot be called by any other name.

[Question] What is the reason for this?

[Answer] The fact that we have wound up pursuing a leveling policy in terms of the wages we pay people who might otherwise be prime movers in the cause of progress. If the average pension of a retired engineer is sometimes lower than the income of a blue-collar worker, then, I ask you, what incentives are there for innovations, improved and more efficient performance?

[Question] The government often thinks that it is enough to appeal to patriotism and dedication, to persuade people to believe in the virtues of socialism....

[Answer] That too is a great misfortune. This is best illustrated by the kind of technological collapse that has occurred, for example, in Great Britain, where the gap between the wages of blue-collar industrial workers and industrial engineers has been narrowed to too great an extent, since even in that country the ratio of an engineer's pension to that of blue-collar industrial worker comes to 1 : 1.5. Industrial engineers, the best ones, have been emigrating to the U. S. Conversely, in the FRG or in France an industrial engineer earns three to four times as much as a blue-collar worker. Well, there is a beneficial side to this too. Fiscal and economic planning levers--this is the crux of the problem. The hope for the consistent implementation and fine-tuning of the economic reforms. For the time being at least, the reforms are working. For instance, we have had to contend with competition in the calculators line: from ELTRA in Bydgoszcz. In the wake of the passage of the economic reforms--since it turned out that they were unable to match our prices--they quit producing calculators. This is an example of how things are supposed to work.

[Question] And so they have entered a field where there is no competition, is that right?

[Answer] It would seem as though you gentlemen are right on that score, but things will change in this respect too. Somebody is still going to turn up who will wind up being a competitor in this market as well. I only hope that nobody is going to show up who will prevent ELTRA from supporting its producers, who stand the chance of either winding up on easy street or going bankrupt. Because such things are happening even now. For example, the high-growth industries are paying high taxes without really knowing how these tax revenues are being spent. Weaker industries are trying to save themselves through subsidies, operational programs, and so on.

[Question] But let's hope that these are just old habits which will be broken. Will you then be able to produce something that will help you to gain a share of the world market? We are not talking about dreams, but rather about the concrete realities which will be a product of a properly managed economy. In particular, we are talking about eliminating the barriers erected by centralized management and replacing them with the institutions of self-determination, self-management, and self-financing.

[Answer] We would even now be able to export our teletransmission processors were it not for political restrictions. The contracts we had have been cancelled. Only IBM, a major corporation with us, and, as I pointed out, this is for us an economically profitable venture.

[Question] Let's dream on--say a few years into the future--when your average Polish firm will be able to pay its bills in hard currency. Will you be able to stand up to the competition of "Datapoint" or "Radio Shack?" What will be the crux of your competitive edge in relation to foreign firms?

[Answer] In the first place, we are here on the scene. Our servicing, spare parts, and direct care and supervision of users will be paid for in zlotys. In the final analysis it is not to be overlooked that this hardware will be our own domestically manufactured hardware based on ideas developed by Polish engineers. Even now we have already built up soun ., punctual, and responsible servicing capacities. Competition exists on the computer hardware market of the socialist countries, where, say the Czechs or the Hungarians, even though they can buy these things from whomever they choose, are still buying it from us and are pleased with the results.

[Question] Where does ELWRO rank in the hierarchy of state-of-the-art data processing hardware?

[Answer] As far as central processing units are concerned, we are at the bottom of the heap. The bottleneck here has to do with the technologies used for the manufacture of domestic main components, technologies which are obsolete.

[Question] Assuming that you had access to the best world-class components and subassemblies, would you be able to produce a computer which would be a match for the high standards of those produced by, say, IBM or Siemens?

[Answer] I believe that we would. Our logic programmers and designers are able to compete with the best the world has to offer. We do not have the technologies because for many years this field was treated like a stepchild. License purchases did not help, since in the electronics industry the pace of change outstrips the time it takes to bring on line even the most advanced licensed technologies. But people are....

[Question] And so how do we get out of this backward position? And is this a realistic prospect at all?

[Answer] I think that it is a realistic prospect. All we need to do is to create the institutional machinery which will make it possible for people to demonstrate all that they are really capable of doing. As I mentioned before, we have invested a great deal of hope in the economic reforms, since I do not see any other solution to this problem.

[Question] Thank you for granting us this interview.

Computer Development Failure

Krakow GAZETA KRAKOWSKA in Polish 16 Dec 82 p 3

[Interview with Witold Korczynski, by Leslaw Peters; date and place not given]

> [Text] Poland was supposed to have been computerized. A domestic digital computers industry was launched. We started importing hardware paid for in dollars. Computer centers started sprouting like mushrooms after a heavy rain. But after a certain period of fascination with the prospects being opened up by computerization disillusionment set in. People began to say that the computer inventory installed in many enterprises was just a bet on future expansion and that some of these capital projects were nothing more than duds.
>
> Why did this happen? Why did Polish industry miss out on an opportunity which was successfully exploited by all of the other highly developed countries around the world? What is going to become of the Polish data processing industry in the wake of the recession and the economic reform? I talked about these things with data processing engineer Witold Korczynski.

[Question] How do you explain the fact that after a period of intensive expansion at the end of the 1960s and beginning of the 1970s Poland's data processing industry went into a steep decline?

[Answer] The data processing revolution was built on a foundation that was a house of cards. Enterprises acquired computer hardware or gained access to it at virtually no cost to themselves. And since they did not pay a single zloty for the systems which they had installed, they did not appreciate it. They took whatever was offered to them, and this in turn meant that computer centers had no incentive to come up with first-class system designs.

[Question] What about the cost effectiveness of all this?

[Answer] The economy was being run in accordance with the principle "either you stand up or you lie down" and it did not make much difference to an enterprise whether it overfulfilled its plan targets or did not fulfill them at all. Many enterprises were downright afraid of data processing. The installation of a data processing system was tantamount to letting a "policeman" into the plant. A computer is neutral and impassive; it makes it impossible to manipulate statistics in a way that allows the enterprise to always wind up fulfilling its plan by 101 percent. Both well-managed and poorly managed enterprises were afraid of data processing. The well-managed enterprises were afraid that their plan targets would be raised.

[Question] You blame the economic planning model in force up until that time for the crisis in the data processing industry. Does that mean that data processing engineers are blameless on this score?

[Answer] In the first place I would not use the term "crisis." Data processing, like the rest of the economy, is going through a recession, but it is still in business in many industrial subsectors which now would not be able to get along without data processing. And as for blame... it certainly is a terrible thing that data processing was turned into a fetish. All those white smocks, rubber-soled shoes, and air conditioning! Data processing was turned into a religion. If a client showed up, say the chief accountant of some enterprise, he was dressed up as if he were going in for surgery and everything was explained to him in a convoluted language peppered with English-language terminology. In the midst of all this an outsider felt lost and was overwhelmed by all of the ceremonial ritual surrounding what is otherwise still a quite mysterious machine. He walked away breathing a sigh of relief as if he had woken up from a bad dream. And yet the fact remains that the same things could have been explained in a relatively straightforward language by using readily understandable metaphors. Nor was there any need to make out computer centers to be religious sanctuaries. These centers ought to be run in the same way as your average good office.

[Question] What about air conditioning? Keeping things clean? It seems to me that on this point data processing engineers would take issue with you.

[Answer] I have been working for 8 years as deputy director of the industry-wide data processing center of the mining, oil, and gas industries in Krakow. During this period we have gotten rid of many features which intimidated our clients. Anybody can come into our center in street shoes. Even on a rainy day, as long as they wipe their feet three times.

The computer stands a very good chance of turning out to be the same kind of tool as, say, the typewriter. This is already beginning to happen elsewhere around the world. In Poland we still suffer from the habit of counting "on our fingers." Only there are some things that simply cannot be counted in this way.

[Question] Some examples please.

[Answer] For my thesis I had to solve 16,000 equations....

[Question] What about something more relevant to everyday life?

[Answer] Just look at how the installation of terminals linked with a central computer in some LOT offices has made it remarkably so much easier to reserve plane seats. One can imagine a similar system being installed in Polish State Railroad ticket offices or in employment offices where every applicant could immediately obtain a list of job openings displayed on a CTS screen. Even the hard times we are going through now (and maybe

these hard times are the most important reason for this) have revealed certain areas of activity where it is necessary to set up rapid-response data banks. A makeshift version of just such an information retrieval was the series "Television for Billions."

[Question] Agreed. Data processing is necessary and useful. But the economic reform calls for enterprises to operate on a self-financing basis, and in this new situation enterprises will be rather fearful about embarking on costly capital investment projects. So, the setbacks suffered by digital computer technology in the economy may worsen.

[Answer] The economic reform also provides for the introduction of market-oriented mechanisms. If they want to sell their products, enterprises are going to have to offer them at competitive prices and, it follows, reduce their production costs. Data processing is one of the ways to accomplish this goal. This works extremely well abroad. Nobody is subsidizing firms like IBM out of pure altruism. The installation of data processing services is regarded as an ordinary capital investment which makes it possible to earn more dollars in less time.

[Question] In a word, your argument is that the economic reform represents an opportunity for data processing.

[Answer] And data processing is an opportunity for the economic reform program. This is an interdependent mechanism. Even now you can picture how enterprises are going to be entering into agreements with computer centers, and the profits generated by digital computer applications will be shared by firms and computer centers. If, for instance, a computer center is instrumental in reorganizing a given firm's operations and the results of such a project prove to be highly profitable, then I do not see any reason why the computer center should not share in the profits earned by a firm by virtue of its rights as the author of such a project.

[Question] Are computer centers themselves also going to have to pay their own way?

[Answer] Yes. And this is why data processing engineers, acting in their own best interests, should be offering first-rate services in those areas where the results of these services will be visible in a thoroughly spectacular way for the average citizen. The point is that we should encourage the public to develop an interest in data processing. Computer terminals should find their way into ticket offices, travel agencies, and stores, and then people will begin to see on a day-to-day basis that data processing makes life easier.

[Question] Let's hope that this will be the case. Thank you for granting us this interview.

Computerized Power Plant Support System

Rzeszow NOWINY in Polish 7 Dec 82 p 3

[Article: "A System Called KSWDB"]

[Text] More and more applications are being found for advanced technologies in factories, scientific laboratories, and in medicine, and these applications are producing great advantages. INTERATOMINSTRUMENT, the International Nuclear Instrumentation Trade Association which has been operating in Poland for 10 years and is widely respected by experts in the field, is making its contribution in this area. In connection with observances of the jubilee anniversary of this Association, whose main objective is to meet the needs of participating countries (Poland, Bulgaria, the USSR, Czechoslovakia, Hungary, and the GDR) for nuclear instrumentation, a specialized exhibition was put on in the Soviet-Polish Friendship House in Warsaw. Many kinds of advanced nuclear technology products were on display at this exhibition. We were represented, among other things, by solid-state radiation detectors, CAMAC system units and modules and several gauge systems based on this system, and the Sakor-B modular instrumentation system for monitoring nuclear reactors. Also on display was the Computerized Support System for Controllers of 360 MW Power Generating Units (abbreviated KSWDB). Three institutions shared in the development of this system, i.e., the Institute for Power Engineering Systems Automation in Wroclaw, the "Polon" Electronic Instrumentation Plant in Warsaw, and the Nuclear Research Institute in Swierk outside Warsaw.

Large power generating units are equipped with extensive control and measurement systems which have to be monitored by computers. The KSWDB system is an industrial prototype, and it is the first large system of this type whose design is based on that of the CAMAC system. It is an information management system which also processes and stores data concerning power generating unit operations. Its "heart" is the microcomputers component which controls electronic output units as well as peripheral hardware such as printers and visual display units. The KSWDB system analyzes and processes approximately 750 analog signals and 1,450 binary signals. It is now in operation at the "Belchatow" power plant. A scaled down version of the system was on display at this exhibition that was based on a single microcomputer and performed some of the primary functions of the KSWDB system.

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POLAND

INEFFECTIVENESS OF COMPUTER APPLICATIONS DESCRIBED

Warsaw TRYBUNA LUDU in Polish 18 Jan 83 p 3

[Article by Andrzej Konieczny]

[Text]

[Text] It is untrue, as the events of the past 10 years have proven, that the application of computers will somehow manage to make organizational and economic progress in Poland inevitable. Data processing failed to nurse our economy back to health. On the contrary, data processing itself was infected by the economy--with speaking in the most general terms--the disease of inefficiency. Can there be any hope, then that the economic reforms which are not being put into practice will also provide a cure for Polish data processing?

Before we attempt to answer this question, it would be a good idea to take a closer look at the symptoms of the disease we are talking about here. To this end, let's turn to the findings of polls and studies conducted in 1981 by the Supreme Chamber of Control.

At the end of 1981, as it turns out, we had a total of 2,633 electronic digital computers in Poland, but only 874 of these were computers with large-scale and medium-scale computing capabilities. The rest were minicomputers. Let's spare ourselves shocking comparisons with countries which have made the greatest advances in data processing. Let us just say that on a worldwide scale there were at that time 88 computers for every 1 million people. Poland had barely one-fourth as many computers.

More or less 10 years ago it was projected that by now we would have at least 5,000 computers in this country. Optimists were even saying that we would have 10,000.

The current scarcity of computers is a direct byproduct of the systematic decline in the output of domestically manufactured computers, a process that has been under way since the middle of the 1970s. This falloff in production has been especially steep and severe in the case of our most important brands of hardware, i.e., ODRA and RYAD computers and the MERA 300 and MERA 400 minicomputers.

And so, in 1977 79 computers were put on the market, whereas 101 were required by the plan; in 1978 62 computers were put on the market instead of the 75 that were needed; in 1979--60 instead of 90; in 1980--35 instead of 87, and in 1981 only 14 computers were produced. In light of these facts, the assurances given in the Sejm to producers, or rather to their parent ministry, to the effect that supply matches demand for computer hardware in Poland to the tune of more than 95 percent sound rather odd to say the very least.

To tell the truth, though, the shortage of computers does not appear to be the principal cause of the shortcomings of the Polish data processing industry. This is because it is hard to go too far in blaming things on the scarcity of computers, since the computers which do exist are being used in a shockingly inefficient manner.

It is estimated that a skillfully used computer should yield benefits on such a scale that the costs of buying it and having it installed would be recovered over the course of 1 year. In Poland it often takes as long as 10 years to do this.

According to the Supreme Chamber of Control, the average operating time of large and medium-sized computers in this country comes to approximately 9.5 hours per day, and the corresponding ratio for minicomputers is not quite 5 hours per day. This disturbingly low average is a product, on the one hand, of the most frequently used machines operated by the so-called Electronic Computer Service Establishments [ZETO] and, on the other hand, of the least used computers operated by the data processing centers affiliated with manufacturers.

Altogether, Poland has around 2,000 diverse data processing centers or almost twice as many more than it had during the middle of the last decade. The snag here is that these centers were often set up without taking into account cost-effectiveness factors, without considering the needs of their--let's call them--founding agencies or their ability to make use of data processing services.

The profitability of using data processing technologies for some purpose or other was almost always ignored in these centers. Computers were used primarily to perform simple calculations for purposes of materials management, personnel management and payrolls, statistical records, production planning, bookkeeping, and so on. In a word, they were used to perform calculations which were not often all that useful and sometimes downright superfluous.

Notwithstanding the lack of interest in computers, the owners of computer centers have been extremely reluctant to perform data processing services on behalf of outside customers.

Are attitudes toward data processing going to change in the wake of the economic reform? For the time being I would be afraid to hazard a guess about this. In this regard it is sufficient to recall the recent predictions about all the surplus manpower which was going to be released by enterprises as

soon as the reforms were put into practice. These predictions were totally off the mark.

Let's take a look at some of the trends that seem to be emerging in this area in various ministerial jurisdictions.

The Ministry of Metallurgy and the Machine Engineering Industry, which accounts for one-third of all of the digital computers installed in our country and which employs around 13,000 persons in its computer centers, has the following to say in a position paper drawn up to address this problem:

"Given the country's present economic situation, where enterprises are allowed to run their own affairs, finding a solution to the problem of providing for a higher rate of installed computer hardware utilization will depend to a great extent on decisions made by the owners of this hardware. The rules of the cost-effectiveness system which has become a part of the national economy, rules which force enterprises to improve their economic performance by, among other things, optimizing production process workflows, optimizing product design processes, enhancing and stabilizing product quality ratings, and optimizing enterprise organizational structures, mean that enterprises are going to be forced to make use of data processing services."

This sounds sensible and convincing. But, at the same time, this ministry states that it intends to help its own enterprises to do this by authorizing one of its departments to exercise management control over data processing applications in these enterprises. So, it is hard to say to what extent the progress of data processing applications in these industries will be a product of cost-effectiveness criteria, to what extent this will be the result of their having been urged to do so by outside forces, or to what extent users will be forced to follow this course.

The observations made along these lines by the ZETO centers under the jurisdiction of the Ministry of Science, Higher Education, and Technology, an institution which provides paid data processing services to various enterprises, strike me as being more credible. At the present time Poland has around 50 ZETO centers located in as many as maybe 35 voivodships and with access to a total of more than 90 computers. With approximately 10 percent of the country's total inventory of computer hardware and employing slightly more than 10 percent of all of this country's data processing specialists, these centers altogether account for more than 15 percent of all of the services provided in this field, in connection with which it should be recalled that they are not interested in pursuing this art for this art's sake as is the case in industrial computer centers.

Since the dissolution of the Computer Science Association, it is truly hard to talk about any common experiences shared by the entire network of ZETO centers, but let's examine some of the things that have been learned by an institution which is right in the center of the capital city's industrial and scientific community, namely, ZOWAR. In pace with progress toward the implementation of the reforms ZOWAR has noted that there has been a sharp

increase in orders from its industrial customers for fast and efficient data processing systems geared toward maximizing the profits and optimizing the performance of business enterprises. These systems are making it possible to make the best decisions when it comes to the playing of the cost-effectiveness game. The fastest growth in this area is occurring in connection with increased orders for engineering design calculation systems which make it possible to come up with, among other things, more economical and more technically refined designs. On the other hand, there has been a drastic cutback in orders for computing services which, in the data processing jargon, are called "chaff." And, so, users are beginning to realize how much they pay for computing services and how much they get out of them. This may represent a sign that the data processing industry is on the road to recovery.

In reference to ZETO it would be a good idea to call attention to one other problem. It is true that right now these centers are not complaining about not having enough work to do. Their sales of data processing services are on the rise, they are making impressive profits, and they are gaining an enormous return on their investment. But it is also true that the process of wear and tear and depreciation of their stock of computer hardware has not come to a stop at a time when they are in the midst of making the transition to running their operations on an autonomous, self-managing, and self-financing basis. And so, left to fend for itself and with earnings of 15 million zlotys a year, what is such a center supposed to do when it comes time to buy a new computer, say and R-32, for 120 million zlotys?

The Ministry of Science, Higher Education, and Technology is of the opinion that the problems of the Polish data processing industry can no longer be resolved by resorting to directive-type actions taken by higher authorities. The recently instituted economic-financial incentive levers should play a critical role in this regard.

The lessons learned by the ZETO centers testify to the usefulness of taking this kind of approach. As it turns out, the demand for data processing services has not diminished in the wake of the economic reforms, rather it is merely the nature of this demand that has changed.

When the Supreme Chamber of Control publicized the findings of its audits pointing to the underutilization of computer capacities, a lot of letters started coming in with questions about where these unused capacities were. So, it would seem that the most important thing to do is to activate those kinds of incentive levers which will encourage computer operators to put their computers to work for the purpose of generating profits or persuade them to hand their machines over to someone else.

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ACTIVITIES OF CENTER FOR SPORTS MEDICINE DESCRIBED

Bucharest SANATATEA in Romanian Dec 82 p 6

[Article by Cristian Ionescu]

[Text] 1 August 1982: Two Romanian athletes, several minutes apart, twice beat the world record in long jump. The performance was achieved first by the Craiova athlete Anisoara Cusmir, with 7.15 m, and, afterwards, by the member of the Bucharest "Rapid" Club, Vali Ionescu, with the fantastic jump of 7.20 m. Only 4 years ago the record was... 5.24 m. How was it possible? The answer of the coach, Prof. Mihai Zaharia: "Through work and tenacity." Here is also the answer of the other "anonym," Dr. Virgil Ignat, head of the laboratory for selection, orientation and guidance in sports training: "Through medical supervision of training and... programming."

Gold at "Medicine Olympics"

Beginning with the Mexico Olympics, called the "Olympics of Sports Medicine," the press has been paying increased attention to the painstaking and anonymous work that underlies the performance. Some even were quick in stating that only the "great scientific powers" can also be "great sports powers." Anyway, in Mexico, in 1968, victories were obtained only by those who were helped to overcome the dual handicap of adapting to the enormous difference in terms of time zone and to an "average" altitude of 2000 m. These included a few Romanian athletes. The performance was also made possible by the work of the 14 experts at the Center for Sports Medicine, established only... 6 years earlier. They had the idea of training in the mountains at an altitude similar to that in the competition and of developing a crescendo programming of sports fitness that was supposed to reach the apex at the time of the start of the contest.

Although young, sports medicine in Romania has a long tradition. Associated with the names of prominent scientists -- Iuliu Hatieganu, Emil Craciun, Ion Pavel, F. C. Ulmeanu, Adrian Ionescu -- is the establishment in 1932 of the Medical Societies for Physical Education and Sports in Bucharest and Cluj, which organize medical monitoring of athletes. On 6 December 1949 the Ministry of Health and Social Welfare decided to organize the network of medicine of physical training. Several years later, on 26 December 1962, established was the Center for Sports Medicine, a unit of countrywide importance and a methodological body for the sports network. On its 20th anniversary the center has 10 specialized medical sections, seven test laboratories,

one pharmacy, one inpatient unit, an antidoping control laboratory and seven medical sports centers in the bases in various areas of the country. As many as 150 specialists -- including 60 with college degrees --are conducting their activity at the center. Their task involves programming of Romanian victories. Objective No 1: obtaining at the 1984 Olympics -- Sarajevo (February) and Los Angeles (July-August) a number of medals that is greater than that obtained at the Moscow Olympics (25 medals including six gold medals).

Price of Victory

In determining the selection criteria for designation of the new candidates to the Olympic podium the sports physician has played a special role. His task was of characterizing the sports branch biologically. How? By analysis of the top foreign and Romanian athletes -- specifically the last world champions and Olympic medal winners. In this manner our sports physicians determined the optimal somatic and functional biotype for top performances in all sports. Tests were added in terms of the health condition of the athletes chosen, the morphologic biotype, the functional condition (neuromental and neuromuscular), the capacity of aerobic and anaerobic effort in connection with the requirements of the test and -- very important -- evaluation of reserves with the attempt at also determining the "biologic price" paid for a specific performance.

In January 1983 the results of the tests will be sent to the Romanian Olympic Committee -- accompanied by a forecast as to who may reach the competition. After the group has been established individual programming starts in terms of the volume and intensity of the training. Concomitantly, the focus is on ensuring intraeffort and posteffort recovery of the system, rehabilitation after traumatism and illness caused by athletic activity and also ensuring a diet that corresponds to the needs of the metabolic process which underlie the physical effort characteristic of the sport practiced. An individual file is set up for each athlete, which contains the medical-sporting conclusions on the prior training year, the medical assessments made at the time of overall examinations, a morbidity chart, a recovery and rehabilitation chart, the conclusions of the self-control conducted by the athlete (reading of daily cardiac frequency, on awakening, duration and quality of sleep, body weight, assessment of appetite and eagerness for training), copies of the athlete's menu, evidence of the measures for the hygiene of the sports base, evidence of the health education classes, and so forth. The list is far from being complete.

Between Ergotropic Effects and Doping

Perhaps no other branch of medicine has provided so many sensational topics as sports medicine. In the search for performances, first in the world of boxing and later, of professional sport, drugs were brought in. This provided outstanding results but also accidents with tragic consequences for athletes. Concomitantly, a whole arsenal of legal means for sustaining the effort has developed. The starting point involved seeking the answer to four questions: 1. What is the factor of limited muscular performance? Answer: exhaustion of muscular glucide reserves, greater lack of oxygen caused by acidosis, production of heat excess; appearance and development of fatigue. 2. What are the psychological factors involved in fatigue? Higher level of lactic acid; metabolic acidosis; hyperglycemia; the central nervous factor and the mental area; the endocrine-neurovegetative area. 3. What physiological means can increase

performance? Only training that generates the increase in the muscular mass, the mechanic efficiency of the muscles. 4. Can drugs increase performance? Yes: if an athlete has a serious accident it is possible to combat the handicap; female hormones can change the cycle and in this way may increase the performance; a diet that induces metabolic alkalosis annihilates acidosis; high amounts of essential metabolites -- vitamins, mineral salts, glucose, aminated acids -- ensure the sustaining of the effort or recovery. Achievements in this area have also been obtained in this country. For instance, as a result of cooperation with the State Institute for Pharmaceutical Control, with the Bucharest Medicopharmaceutical Institute, the chair of pharmacology, and the Chemicopharmaceutical Institute, the last 5 years saw a number of products that are used not only by athletes but by all the people patented by OSIM [State Office for Inventions and Trademarks] and approved by the Ministry of Health and included in the lists of pharmaceutical products. They include: Polivitaminant S and Polimineralizant S, a complex of nine minerals, unique in the world, for electrolytic balance after effort; Agentol -- drinkable vials -- that sustains short-duration effort; Vitaspol -- drinkable vials -- for recovery after effort; Efortex -- to sustain long-duration effort; Elental -- tablets, from glucose and vitamins, for recovery; four cremes: Trofic I, II, III and IV, for stimulating massage.

Immediate Projects

On the 50th anniversary of the Medical Society for Physical Training and the 20th anniversary of the Center for Sports Medicine, Lecturer Dr. Ioan Dragan told us about future projects:

Projects? In the area of high performance sports, to enhance our input into athletic training, in achieving sports fitness at the relevant point -- the competition -- in training for the contest and recovery after effort, in protection and promotion of the athletes' health. How can these goals be achieved? By using the advanced experience of the Romanian medical school, of world medicine, let us creatively capitalize on all the new developments, all that is efficient, switching from the assessing stage -- which is still found as a style of work -- to the strictly scientific active stage, by which the sports physician identifies with the athlete and coach in the work process: athletic training. In the area of mass sports, there is the need for developing.... scientific programs, like in the case of sensible nutrition, both at the point of production and at home, only in this way convincing with respect to the benefits of sports for health or justifying by deeds the present designation for sports medicine as the "clinic of the healthy person -- the medicine of the future."

Let us wish them success.

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